**UNIVERSITY OF TRIESTE**
**ACADEMIC AND TEACHING REGULATIONS**
**for students enrolled in the academic year 2025/26**

**Master's degree programme in COMPUTER ENGINEERING – LM-32**

**Art. 1 - Objective**

1. These regulations define in detail the contents of the related General Regulations (*Ordinamento Didattico*) of the Master's degree programme in COMPUTER ENGINEERING, under art. 12, s. 1 of the Ministerial Decree no. 270/2004 on "Amendments to the regulation containing the rules concerning the teaching autonomy of universities".
2. The General Regulations and the organisation of the Master's degree are defined in respect of freedom of teaching and the rights and duties of lecturers and students.

**Art. 2 - Contents of the Academic and Teaching Regulations**

1. The Academic and Teaching Regulations define the implementation of the General Regulations of the degree course and its organisational aspects.
2. In accordance with art. 4, s. 2 of the Teaching Regulations of the University of Trieste, the Academic and Teaching Regulations define:

a) the list of modules (and their scientific sector), divided by year and their partition into sub-modules, and other teaching activities;
b) the method for carrying out laboratory and practical activities, and traineeships;
c) the expected learning outcomes (see annex F), the number of university credits (ECTS) and any prerequisites for modules and other teaching activities, all divided by year;
d) the curricula available to students and, where necessary, how to present the individual study plan;
e) the provisions on any compulsory attendance and/or any alternative learning plan for student workers and/or disabled people;
f) the entry requirements, the procedures to verify them at enrolment and any provisions on preparatory and supplementary activities aimed at fulfilling a conditional advancement;
g) the procedure for admission to the final examination and graduation;
h) the procedure for verification of knowledge of the foreign language at the required level;
i) the possible use of English as the teaching language for some modules.

**Art. 3 - Structure and organisation of the Master's degree programme**

The following documents and regulations set the organisation and management of the degree course:

- University Charter;
- Teaching Regulations of the University;
- General Regulations of the Master's degree;
- List of taught modules and other teaching activities;
- Annual Study Plan.

**Art. 4 - General Regulations of the Master's degree programme**

1. The General Regulations set the structure and organisation of the Master's degree programme. In particular, they contain:

a) the name and the ministerial class to which it belongs;
b) the expected learning outcomes of the programme in agreement with the European qualification framework;

c) career opportunities in relation to the activities listed by ISTAT;
d) the plan of teaching activities in agreement with the provisions of the ministerial class to which the course belongs;
e) the number of ECTS of all teaching activities;
f) the entry requirements and the procedure to verify them at enrolment;
g) the method for carrying out the final examination and graduation;

2. The General Regulations can be found in the SUA (*Scheda Unica Annuale*) statement of the programme.

**Art. 5 - Plan of teaching activities**

1. The plan of teaching activities specifies:
a) the list of taught modules, their scientific sectors and other teaching activities;
b) the sub-modules into which a module may be potentially subdivided and their scientific sectors;
c) the number of ECTS of each module or teaching activity;
d) any progression rules between modules;
2. The plan of teaching activities can be found in the SUA statement of the programme.

**Art. 6 - Annual study plan**

The annual study plan is updated annually and can be found in Annex A that is reported also in the SUA statement of the programme.

**Art. 7 – Admissions**

In order to be enrolled students must meet specific curricular requirements and must be adequately prepared. Details can be found in Annex B.

**Art. 8 – Award of the degree**

1. In order to graduate a student will have to acquire 120 ECTS.
2. Given that each year conventionally corresponds to 60 ECTS, the duration of the programme is two years.
3. The degree can be awarded in less than two years should the student has acquired all 120 ECTS included in their study plan.

**Art. 9 - Structure of the Master's degree programme**

1. The Master's degree programme entails the following types of teaching activities:
a) core teaching activities (teaching activity of type B - TAF B);
b) teaching activities related to the core ones, also with reference to cross-disciplinary training (TAF C);
c) optional teaching activities (TAF D);
d) teaching activities related to the final examination and linguistic knowledge (TAF E);
e) teaching activities to improve linguistic knowledge, any traineeships, computer skills, telematic and relational skills, and all skills useful for the professional career (TAF F).
2. The number of ECTS assigned to each of the listed activities is specified in Annex A.
3. One ECTS corresponds to 25 hours of overall commitment per student. Usually, 1 ECTS corresponds to 8 hours of classroom teaching.

**Art. 10 – Laboratory and practical activities, and traineeships**

Such activities are promoted and coordinated by members of the Board of Studies. More details can be found in Annex C.

**Art. 10bis - Foreign Languages**

Verification of proficiency in spoken and written English, at least equivalent to level B2 of the Common European Framework of Reference for Language Proficiency, is part of the assessment of the applicant's personal preparation. This competence can be taken from the Curriculum studiorum or from an appropriate certificate issued by a qualified institution recognised as valid by the University. In all other cases, admission is verified by a test prepared by the University.

**Art. 11 - Teaching activities preparing for the final examination**

1. In agreement with its learning outcomes and assigned number of ECTS, the final examination is an extensive project or methodological work presented together with a report (Master's dissertation). The graduating student will have to prove through the dissertation that they master the topic, they can work independently and can communicate effectively. The topic needs to be pertinent to the traineeship or to issues studied throughout the programme and will be developed with the supervision of an academic staff (supervisor) and, if necessary, with the help of co-supervisors; the latter may be an academic staff of an external expert, especially if the dissertation is written during a traineeship to the premises of an external partner (either a company or an institution other than the University of Trieste).
2. The dissertation is presented and discussed during a pre-graduation examination in front of a Board nominated by the Head of Department. The Board consists of at least 3 members, one of which is the supervisor; others members can be either academic staff or external lecturers or experts. The committee assesses the content and the presentation and marks (maximum 30 marks).
3. The final mark of the Master's degree programme (a mark out of 110) is calculated through following formula:

$$L = \frac{110}{30}\,\frac{N_{cr} * E + n * P}{N_{cr} + n} + \Delta$$

with

$$\Delta = t + d + l + c \qquad \Delta = 0 \div 6$$

where

- $N_{cr}$ sum of the number of ECTS of modules or teaching activities for which a mark is assigned;
- $N$ number of ECTS of the final examination;
- $E$ weighted average of the marks of modules or teaching activities for which a mark is assigned;
- $P$ examination mark assigned by the Pre-graduation Board;
- $\Delta$ increment determined by:
  - $t$ type of dissertation, with $t$ = 0; 1; 2
    (0: literature-review; 1: design, workshop; 2: research project);
  - $d$ duration of enrolment in the programme, with $d$ = 0; 1
    (0: duration> 2.5 years (i.e. beyond Extraordinary session of Year 2); 1: all other cases);
  - $l$ value based on number of marks "30 *cum laude*", with $l$ = 0; 1; 2
    (0: no. "30 cum laude" < 4; 1: 4 ≤ no. "30 cum laude" < 8; 2: no. "30 cum laude"≥ 8);
  - $c$ additional mark assigned by the Graduation Board, with c = 0; 1.

The final mark $L$ is rounded off (e.g. 107.49 becomes 107 and 107.50 becomes 108).

4. The number of ECTS assigned to the final examination is specified in Annex A.

**Art. 12 - Examination progression**

1. In order to guarantee an appropriate teaching and learning path, the progression between examinations must be respected in accordance with the Teaching Regulations of the University.
2. The list of progression of examinations can be found in Annex D.

**Art. 13 - Specific curricula**

1. Within the programme, modules and teaching activities can be combined to offer specific curricula and to fulfil different cultural or professional needs.
2. Any specific curricula can be found in Annex A.

**Art. 14 - Submission of an individual study plan**

1. As an alternative to the regular procedure, a student can present an individual study plan for each academic year which includes from a minimum of 48 to a maximum of 84 ECTS, including those foreseen in the study plan of the student in the previous year and not yet acquired, with the constraint that the number of ECTS corresponding to modules or other teaching activities for which attendance has yet to be acquired should not exceed 60.
2. The Board of Studies may allow students to replace their modules with other modules offered from the University of Trieste or from other programmes of foreign Universities (either Bachelor's or Master's degrees) based on the coherence with the expected learning outcomes of the programme and the number of ECTS.

**Art. 15 - Assessment**

1. *Criteria for the arrangement of examination boards.* The examination board consists of two members: the module leader and another expert that can be either an academic staff or an expert of the subject. Non-academic staff experts are authorised by the Departmental Council. If the module is composed of two or more sub-modules with different leaders, they all must be part of the examination board.
2. *Assessment of taught modules and other teaching activities.* Assessment can take place with either ongoing tests or a final test to be held at the end of the module or activity.
*3. Recording of the mark for examination composed of multiple tests.* When an examination is composed of multiple tests, recording of the mark is performed only when the final mark is available.
*4. Rules for repeating failed examinations during the same academic year.* Students can repeat a failed examination in all the exam sessions of the academic calendar.

**Art. 16 - Mandatory attendance**

Attendance is not mandatory with the exception of any mandatory activities specified for each course.

**Art. 17**

Abrogated.

**Art. 18 - Criteria for recording ECTS for activities and skills obtained prior to the enrolment**

The Board of Studies can recognise a number of ECTS for activities performed or skills obtained prior to the enrolment to the Master's degree, if such activities are deemed coherent with the teaching activities and the expected learning outcomes of the programme as well as the duration, as specified in Annex E.

**Art. 19 - Minimum number of ECTS to be acquired by the student in an established lapse**

Any requirements

**Art. 20 - Nature of these Regulations**

These Regulations are defined as Academic and Teaching Regulations under art. 12 of the Ministerial Decree no. 270/2004.

**Annexes**

Ann. A: Annual study plan
Ann. B: Entry requirements
Ann. C: Traineeships
Ann. D: Progression rules
Ann. E: Recognition of previously-acquired skills or qualifications
Ann. F: Learning outcomes and teaching activities: tuning matrix

UNIVERSITÀ DEGLI STUDI DI TRIESTE

Dipartimento di Ingegneria e Architettura

**UNIVERSITY OF TRIESTE**

**ACADEMIC AND TEACHING REGULATIONS**

**for students enrolled in the academic year 2025/26**

**Master's degree programme in COMPUTER ENGINEERING– LM-32**

## ANNEX A
## ANNUAL STUDY PLAN

The Computer Engineering degree program has 4 Curricula:

- INFORMATICS
- ELECTRONIC SYSTEMS
- ROBOTICS AND ARTIFICIAL INTELLIGENCE
- NETWORKS AND INTERNET OF THINGS

The courses are classified based as follows (type of educational activity, "TAF"):

TAF A = base courses

TAF B = characterizing courses

TAF C = complementary courses

TAF D = elective courses

TAF E = final thesis

TAF F = other activities

| **Curriculum "INFORMATICS"** | | | | | |
|---|---|---|---|---|---|
| **I anno** | | | | | |
| *Insegnamento* | *Modulo* | *Settore* | *TAF* | *CFU* | *SEM* |
| Machine learning | Machine learning | ING-INF/05 | B | 6 | 1 |
| | Evolutionary robotics | ING-INF/05 | B | 3 | 1 |
| Advanced internet technologies | | ING-INF/05 | B | 6 | 1 |
| Software development methods | | ING-INF/05 | B | 6 | 1 |
| Complexity and cryptography | | ING-INF/05 | B | 9 | 2 |
| Cybersecurity | | ING-INF/05 | B | 9 | 2 |
| Mathematical optimisation | | MAT/09 | C | 6 | 2 |
| **II anno** | | | | | |
| *Insegnamento* | *Modulo* | *Settore* | *TAF* | *CFU* | *SEM* |
| Cybersecurity Lab | | ING-INF/05 | B | 6 | 1 |
| Web application programming | | ING-INF/05 | B | 6 | 1 |
| Information retrieval and data visualization | | INF/01 | C | 6 | 2 |
| Optimization for artificial intelligence | | INF/01 | C | 6 | 1 |
| Data-driven systems engineering | | ING-INF/05 | B | 9 | 1 |
| Elective courses | | / | D | 12 | |
| Internship | | / | F | 6 | |
| Final project | | / | E | 24 | |

| Curriculum "ELECTRONIC SYSTEMS" | | | | | |
|---|---|---|---|---|---|
| **I anno** | | | | | |
| *Insegnamento* | *Modulo* | *Settore* | *TAF* | *CFU* | *SEM* |
| Machine learning | Machine learning | ING-INF/05 | B | 6 | 1 |
| | Evolutionary robotics | ING-INF/05 | B | 3 | 1 |
| Advanced internet technologies | | ING-INF/05 | B | 6 | 1 |
| Data-Driven digital systems | Data-Driven digital systems | ING-INF/04 | B | 6 | 1 |
| Wireless networks and Internet of Things | Wireless networks | ING-INF/05 | B | 3 | 1 |
| | Digital communication | ING-INF/05 | B | 6 | 2 |
| Digital signal and image processing | Digital signal processing | ING-INF/01 | C | 6 | 1/2 |
| | Digital image processing | ING-INF/01 | C | 3 | 2 |
| Digital electronics and devices | | ING-INF/01 | C | 6 | 2 |
| Cybersecurity | | ING-INF/05 | B | 9 | 2 |
| **II anno** | | | | | |
| *Insegnamento* | *Modulo* | *Settore* | *TAF* | *CFU* | *SEM* |
| Computer vision and pattern recognition | | ING-INF/04 | B | 6 | 1 |
| Electronics for Wireless Networks | | ING-INF/01 | C | 3 | 1 |
| Electronic systems design | | ING-INF/01 | C | 9 | A |
| Embedded systems | | ING-INF/01 | C | 9 | 2 |
| Elective courses | | / | D | 12 | |
| Internship | | / | F | 6 | |
| Final project | | / | E | 21 | |

| Curriculum "ROBOTICS and ARTIFICIAL INTELLIGENCE" | | | | | |
|---|---|---|---|---|---|
| **I anno** | | | | | |
| *Insegnamento* | *Modulo* | *Settore* | *TAF* | *CFU* | *SEM* |
| Machine learning | Machine learning | ING-INF/05 | B | 6 | 1 |
| | Evolutionary robotics | ING-INF/05 | B | 3 | 1 |
| Advanced internet technologies | | ING-INF/05 | B | 6 | 1 |
| Data-Driven digital systems | Data-Driven digital systems | ING-INF/04 | B | 6 | 1 |
| | Digital systems | ING-INF/04 | B | 3 | 1 |
| Cybersecurity | | ING-INF/05 | B | 9 | 2 |
| Control theory | | ING-INF/04 | B | 9 | 2 |
| Mathematical optimisation | | MAT/09 | C | 6 | 2 |
| **II anno** | | | | | |
| *Insegnamento* | *Modulo* | *Settore* | *TAF* | *CFU* | *SEM* |
| Computer vision and pattern recognition | | ING-INF/04 | B | 6 | 1 |
| Control of cyber-physical systems | | ING-INF/04 | B | 6 | 1 |
| Learning-based control | | ING-INF/04 | B | 6 | 1 |
| Robotics | Robotics | ING-IND/13 | C | 6 | 2 |
| | Mobile robots | ING-IND/13 | C | 6 | 2 |
| Elective courses | | / | D | 12 | |
| Internship | | / | F | 6 | |
| Final project | | / | E | 24 | |

| Curriculum "NETWORKS AND INTERNET OF THINGS" | | | | | |
|---|---|---|---|---|---|
| **I anno** | | | | | |
| *Insegnamento* | *Modulo* | *Settore* | *TAF* | *CFU* | *SEM* |
| Machine learning | Machine learning | ING-INF/05 | B | 6 | 1 |
| | Evolutionary robotics | ING-INF/05 | B | 3 | 1 |
| Advanced internet technologies | | ING-INF/05 | B | 6 | 1 |
| Wireless networks and Internet of Things | Wireless networks | ING-INF/05 | B | 3 | 1 |
| | Digital communication | ING-INF/05 | B | 6 | 2 |
| Digital signal and image processing | Digital signal processing | ING-INF/01 | C | 6 | 1/2 |
| | Digital image processing | ING-INF/01 | C | 3 | 2 |
| Cybersecurity | | ING-INF/05 | B | 9 | 2 |
| Complexity and cryptography | | ING-INF/05 | B | 9 | 2 |
| **II anno** | | | | | |
| *Insegnamento* | *Modulo* | *Settore* | *TAF* | *CFU* | *SEM* |
| Air and satellite networks | | ING-INF/03 | C | 6 | 1 |
| Electronics for Wireless Networks | | ING-INF/01 | C | 3 | 1 |
| Control of cyber-physical systems | | ING-INF/04 | B | 6 | 1 |
| Microwave and optical networks | | ING-INF/03 | C | 9 | 2 |
| Antennas | | ING-INF/02 | C | 6 | 2 |
| Elective courses | | / | D | 12 | |
| Internship | | / | F | 6 | |
| Final project | | / | E | 21 | |

**Elective courses**

In the study plan, the student must register for elective courses (TAF D, 12 CFU) that can be chosen from the following set.

The student cannot enroll in an elective course if s/he has already given the same or equivalent exam in previous courses of study.

- courses of curricula of this degree, different from the curriculum chosen by the student
- courses of a master degree in Engineering
- courses of the degree in Data Science and Artificial Intelligence
- courses of the degree in Physics
- courses of the degree in Mathematics

**UNIVERSITY OF TRIESTE**

**ACADEMIC AND TEACHING REGULATIONS**
**for students enrolled in the academic year 2025/26**

**Master's degree programme in COMPUTER ENGINEERING – LM-32**

**ANNEX B**
**ENTRY REQUIREMENTS**

Admission to the Master's Degree Course in Computer Engineering (LM-32 class of Master's Degrees in Computer Engineering) requires
- the possession of curricular requirements
- the adequacy of personal preparation.

**PART 1: CURRICULAR REQUIREMENTS**

The curricular requirements for admission to the Master's Degree Course in Computer Engineering consist in the possession of a three-year university degree or diploma, or a master, specialised or single-cycle degree, or other study qualification acquired abroad and recognised as equivalent and suitable, which entails adequate preparation of the student for the Degree Course.

The three-year degree qualification must have been obtained in a degree programme in Information Engineering (Class L-8) or Computer Science and Technology (L-31) active pursuant to Ministerial Decree 270/04, or in the corresponding degree classes envisaged by Ministerial Decree 509/99.

As an alternative to the possession of a degree in the degree classes indicated above, graduates holding the envisaged degrees are admitted to the Master's Degree Course in Computer Engineering, provided that the minimum number of credits (CFU) in sets of scientific-disciplinary sectors (SSD) as defined below have been achieved in the course of study previously covered

- at least 24 CFUin one or more disciplines defined by the following SSDs: MAT/01-09, FIS/01-08, SECS-S/01 and SECS-S-06 (mathematics, physics, statistics, mathematical methods of economics and financial sciences);
- at least 18 CFU in the disciplines defined by the following SSDs: ING-INF/05, INF/01 (computer engineering, informatics);

Students in possession of a degree obtained abroad are admitted to the Master's Degree Course if the degree is recognised as suitable in relation to the degree classes indicated above, or if they possess the minimum number of CFUs in certain SSDs as indicated above following conversion of the credits or degrees held.

**PART 2: ADEQUACY OF PERSONAL PREPARATION**

Admission to the Master's Degree Course in Computer Engineering requires verification of adequate individual preparation.

A degree mark greater than or equal to 85/110 (also converted to this mark in the case of a foreign

qualification) is considered valid and sufficient to certify adequate individual preparation.
For candidates whose degree mark is lower than 85/110, admission is subject to the evaluation of the candidate's curriculum by the Teaching Commission of the Master's Degree Course. On the basis of the curriculum assessment, personal preparation may be considered: a) adequate with consequent acceptance of admission to the degree course; b) inadequate with consequent refusal of admission to the degree course.

**PART 3: LANGUAGE SKILLS**

Verification of written and oral knowledge of the English language, corresponding at least to level B2 of the Common European Framework of Reference for Languages, forms part of the assessment of the candidate's personal preparation. This competence may be inferred from the curriculum studiorum, from suitable certification or from a certificate recognised as valid by the University and is understood to be fulfilled in the case of candidates who are native speakers of English.
The deadlines for matriculation and enrolment are set by the University's teaching calendar.

# ANNEX C
# TRAINEESHIPS

Some subjects include practical and laboratory activities. These activities are an integral part of the courses themselves and therefore do not allow additional credits to be acquired.

Internship activities are envisaged for the course of study in question.

The internship activity (area F) - subject to the control of a tutor and suitably documented - is approved (or not) by a commission consisting of the tutor himself and another lecturer. The approved internship activity is graded at 3 CFU if it corresponds to a minimum of 75 hours, at 6 CFU if it corresponds to a minimum of 150 hours in accordance with the Study Plan. No grades are therefore attributed to the activity itself. Should the student carry out the placement outside the university, at a company, he/she must contact the Didactic Secretariat of the Department of Engineering and Architecture before starting the placement, which will provide him/her with insurance cover and draw up an appropriate agreement.

## ANNEX D
## PROGRESSION RULES

No progression rules are indicated between the subjects of the Study Plan.

**UNIVERSITY OF TRIESTE**
**ACADEMIC AND TEACHING REGULATIONS**
**for students enrolled in the academic year 2025/26**

**Master's degree programme in COMPUTER ENGINEERING – LM-32**

## ANNEX E
## RECOGNITION OF PREVIOUSLY ACQUIRED SKILLS AND QUALIFICATIONS

The Course Council (CCS) may recognise some credits for activities carried out or skills acquired prior to enrolment in the Course of Study on the basis of the congruence of the teaching and/or training activities followed with the educational objectives of the Course of Study and the correspondence of the relative teaching loads, as indicated below, except as provided for by any specific agreements stipulated with the University and/or the Department of Engineering and Architecture:

- professional competences and skills may be recognised in F;
- IT skills and abilities may be recognised under F.

With particular regard to transfers from other study courses, including those from other universities, the CCS assesses the recognition of credits on a case-by-case basis, possibly resorting to interviews to verify the knowledge actually possessed or to supplementary tests/examinations; any failure to recognise credits is adequately justified.

# annex F - matrice tuning - 25-26

| RISULTATI DI APPRENDIMENTO ATTESI | | | I ANNO | | | | | | | | | II ANNO | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aree di apprendimento | Descrittori di Dublino | Dettaglio descrittori | Digital Signal and Image Processing | Digital electronics and devices | Control Theory | Wireless network and internet of things | Data-driven digital systems | Complexity and cryptography | Cybersecurity | Machine Learning and Evolutionary Robotics | Software Development methods | Mathematical Optimisation | Advanced internet technologies | Robotics + mobile robots | Electronics for Wireless Networks | Embedded Systems | Electronic systems design | Antennas | Air and satellite networks | Microwave and optical networks | Computer Vision and Pattern Recognition | Cyber-physical systems | Data-driven Systems Engineering | Web application programming | Optimization for Artificial Intelligence | Information retrieval and data visualisation | Learning-based control | Control of cyber-physical systems | Cybersecurity Lab | Altre attività | conoscenza lingua straniera | prova finale |
| Aspetti teorici dell'ingegneria informatica *(quadro A4.b.2 della SUA-CdS)* | Conoscenza e capacità di comprensione (knowledge and understanding) insieme di fatti, principi, teorie e pratiche | *Funzionamento ed operatività di sistemi informatici in ambienti adversarial* | | | | | | x | | | | | | | | | | | | | | | | | | | | | | x | x |
| | | *Requisiti di costo, funzionali e non funzionali dei problemi in ambito informatico* | | | | x | | x | x | x | x | | x | | | x | | | | | | x | x | x | x | | x | x | x | | x | x |
| | | *Metodologie per la sintesi automatica di procedure ed algoritmi a partire da grandi quantità di dati* | | | | | | | | x | | | | | | | | | | | | | | | | | | | | | x | x |
| | | *Metodi, terminologia e notazione comune per l'apprendimento automatico supervisionato e non supervisionato* | | | | | | | | x | | | | | | | | | | | | | x | | | | | | | | x | x |
| | | *Indici e procedure di valutazione di sistemi di apprendimento automatico supervisionato e non supervisionato* | | | | | | | | x | | | | | | | | | | | | | x | | | | | | | | x | x |
| | | *Formulazione di modelli discreti e continui per l'ottimizzazione vincolata e globale* | | | | | | | | x | | x | | | | | | | | | | | | | | | | | | | x | x |
| | | *Conoscenza delle principali architetture di rete e del funzionamento dei differenti livelli che compongono lo stack di Internet* | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | x | x |
| | | *Protocolli e architetture di comunicazione adatti a scenari Internet ed a dispositivi internet of Things, in termini di scalabilità, estensione geografica, sicurezza.* | | | | x | | | | | | | x | | | | | | x | | | | | | | | | | | | x | x |
| | | *Conoscenza dei più recenti protocolli utilizzati nel Web e delle ragioni che ne hanno dettato le scelte progettuali* | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | x | x |
| | | *Tecniche e concetti per la progettazione e realizzazione di sistemi informativi di grandi organizzazioni* | | | | | | | | | | | | | | | | | | | | | x | | | | | | | | x | x |
| | | *Tecniche e concetti per lo sviluppo collaborativo di sistemi software complessi in ambito industriale* | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | x | x |
| | | *Tecniche per la progettazione e lo sviluppo software orientate al testing* | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | x | x |
| | | *Tecniche e concetti per lo sviluppo di applicazioni web* | | | | | | | | | | | | | | | | | | | | | x | x | | | | | | | x | x |
| | | *Requisiti di usabilità ed interoperabilità nelle applicazioni web* | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | x | x |
| | | *Tecniche e concetti per la ricerca automatizzata di informazioni in grandi quantità di dati non strutturati* | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | x | x |
| | | *Tecniche per la comunicazione e visualizzazione efficace di conoscenza estratta da grandi quantità di dati.* | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | x | x |
| | | *Strumenti concettuali della crittografia.* | | | | | | x | | | | | | | | | | | | | | | | | | | | | | | x | x |
| | | *Principali protocolli per la comunicazione con crittografia a chiave privata e con crittografia a chiave pubblica* | | | | | | x | | | | | x | | | | | | | | | | | | | | | | | | x | x |
| | Conoscenza e capacità di comprensione applicate (applying knowledge and understanding) azioni e procedimenti la cui padronanza è ritenuta indispensabile per applicare le conoscenze e risolvere determinati compiti. | *Valutare i principali attacchi informatici fattibili in un dato scenario applicativo ed architetturale ed i corrispondenti meccanismi di mitigazione disponibili.* | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | x | x |
| | | *Valutare i principali rischi associati alle vulnerabilità informatiche in un dato scenario applicativo ed architetturale ed i corrispondenti meccanismi di prevenzione e mitigazione disponibili.* | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | x | x |
| | | *Valutare ed implementare le tecniche più adatta per l'autenticazione e l'autorizzazione in applicazioni web* | | | | | | | x | | | | x | | | | | | | | | | | | | | | | | | x | x |
| | | *Valutare quando un problema è risolvibile con tecniche di apprendimento automatico e darne una formulazione astratta* | | | | | | | | x | | | | | | | | | | | | | | | x | | | | | | x | x |
| | | *Progettare, realizzare e valutare sperimentalmente soluzioni applicative basate su apprendimento automatico in termini di efficacia, efficienza, interpretabilità e applicabilità* | | | | | | | | x | | | | | | | | | | | | | | | x | | | | | | x | x |
| | | *Progettare ed implementare algoritmi esatti, approssimati e (meta-)euristici per la risoluzione di problemi di ottimizzazione vincolata e globale.* | | | | | | | | x | | x | | | | | | | | | | | | | x | | | | | | x | x |
| | | *Determinare l'architettura di comunicazione adatta per i requisiti di uno scenario applicativo distribuito in termini di prestazioni, scalabilità, sicurezza* | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | x | x |
| | | *Capacità di progettare ad alto livello una rete di telecomunicazione, padroneggiando i concetti di routing, reti locali, VLAN e VPN* | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | x | x |
| | | *Capacità di comprendere il funzionamento di una rete esistente e di utilizzare i più comuni strumenti di ispezione e analisi del traffico* | | | | | | | | | | | x | | | | | | | | | | | | | | | | | | x | x |
| | | *Progettare e realizzare prototipi software con strumenti, linguaggi e librerie di riferimento nel settore applicativo specifico* | | | | | | | | x | | | | | | | | | | | | | x | x | x | x | | | | | x | x |
| | | *Determinare le componenti software necessarie a livello sistemistico ed architetturale in base ai requisiti del settore applicativo specifico* | | | | | | | | x | | | | | | | | | | | | | x | x | x | x | | | | | x | x |
| | | *Adottare tecniche di sviluppo software adatte per applicazioni in ambito industriale* | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | x | x |
| | | *Adottare tecniche di testing e di refactoring* | | | | | | | | | x | | | | | | | | | | | | | | | | | | | | x | x |
| | | *Valutare ed adottare le principali pratiche di design di interfacce web ed i corrispondenti principi di usabilità e accessibilità* | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | x | x |
| | | *Valutare le principali tecniche di sviluppo frontend e backend più adatte in uno specifico ambito applicativo, inclusi i framework e i linguaggi di programmazione strategici* | | | | | | | | | | | | | | | | | | | | | | x | | | | | | | x | x |
| | | *Determinare le metodologie di estrazione automatizzata di informazione da grandi quantità di dati non strutturati adatte ai requisiti del dominio applicativo specifico.* | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | x | x |
| | | *Realizzare strumenti per l'analisi e visualizzazione interattiva di conoscenza estratta da grandi quantità di dati.* | | | | | | | | | | | | | | | | | | | | | | | | | x | | | | x | x |
| | | *Valutare i principali attacchi informatici fattibili in specifici ambiti applicativi web ed i corrispondenti meccanismi di mitigazione.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | x | x |
| | | *Valutare i principali attacchi informatici al livello dei protocolli di comunicazione fattibili in specifici ambiti applicativi ed i corrispondenti meccanismi di mitigazione.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | x | x |
| | | *Essere in grado di progettare una sessione di comunicazione di crittografia a chiave privata e di crittografia a chiave pubblica* | | | | | | | x | | | | | | | | | | | | | | | | | | | | | | x | x |
| Aspetti teorici, metodologici e tecnologici nell'ambito delle Reti di Telecomunicazioni e e Internet of Things (quadro A4.b.2 della SUA-CdS) | Conoscenza e capacità di comprensione (knowledge and understanding) insieme di fatti, principi, teorie e pratiche | *Teoria dell'informazione, modulazioni numeriche, codici per la protezione dall'errore* | | | | x | | | | | | | | | | | | | x | | | | | | | | | | | x | x |
| | | *Sistemi di comunicazione, risorse e requisiti per l'uso efficiente e sicuro: banda, potenza/energia, qualità del servizio.* | | | | x | | | | | | | | | | | | | x | | | | | | | | | | | x | x |
| | | *Architetture dei moderni sistemi wireless e wired e relativi standard (sistemi cellulari: GSM, UMTS, LTE; WLAN: IEEE 802.11; WPAN: IEEE 802.15; Reti di sensori; Internet of Things).* | | | | x | | | | | | | | | | | | | x | x | | | | | | | | | | x | x |
| | | *Caratterizzazione e modellizzazione del canale di comunicazione wireless e wired.* | | | | x | | | | | | | | | | | | | x | x | | | | | | | | | | x | x |
| | | *Tecnologie abilitanti per il canale wireless: diversità/multiplazione. OFDM, CDMA, MIMO, V-Blast* | | | | x | | | | | | | | | | | | | x | | | | | | | | | | | x | x |
| | | *Caratterizzazione di sistemi elettronici utilizzati in campo wireless.* | | | | | | | | | | | | | x | | | | | | | | | | | | | | | x | x |
| | | *Progetto e realizzazione di sistemi di comunicazione mediante dispositivi programmabili (FPGA, DSP, USRP).* | | | | | | | | | | | | | x | | | | | | | | | | | | | | | x | x |
| | | *Caratterizzazione di dispositivi e sistemi ad alta frequenza sia nell'ambito delle microonde che nell'ambito dell'ottico.* | | | | | | | | | | | | | x | | | | | | x | | | | | | | | | x | x |
| | | *Caratterizzazione e progetto di antenne e sistemi di antenna.* | | | | | | | | | | | | | | | | | x | | | | | | | | | | | x | x |
| | | *Elaborazione e trasporto informazione multimediale mediante rete eterogenea.* | x | | | x | | | | | | | | | | | | | | x | | | | | | | | | | x | x |
| | Conoscenza e capacità di comprensione applicate (applying knowledge and understanding) azioni e procedimenti la cui padronanza è ritenuta indispensabile per applicare le | *Calcolare la capacità di sistemi di comunicazione numerica, progettare tecniche efficienti di modulazione e codifica, anche di tipo adattativo* | | | | x | | | | | | | | | | | | | x | | | | | | | | | | | x | x |
| | | *Caratterizzare i canali di comunicazione, con particolare riferimento ai canali wireless* | | | | x | | | | | | | | | | | | | x | | | | | | | | | | | x | x |
| | | *Utilizzare e sviluppare tecniche di simulazione per il progetto e l'ottimizzazione di una rete di comunicazione.* | | | | x | | | | | | | | | | | | | x | | | | | | | | | | | x | x |
| | | *Conoscere le principali tecniche e gli attuali standard internazionali di comunicazione wireless, ed essere in grado di svolgere ruoli innovativi in questo ambito* | | | | x | | | | | | | | | x | | | | x | | | | | | | | | | | x | x |
| | | *Progettare i principali componenti elettronici richiesti in un sistema wireless.* | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | x |
| | | *Progettare e realizzare sistemi di comunicazione prototipali mediante dispositivi programmabili (FPGA, DSP, USRP).* | | | | | | | | | | | | | x | | | | | | | | | | | | | | | x | x |
| | | *Progettare sistemi di trasmissione ad alta frequenza sia nel campo ottico che in quello delle microonde* | | | | | | | | | | | | | x | | | | | | x | | | | | | | | | x | x |
| | | *Effettuare misurazioni su sistemi a microonde e ottici* | | | | | | | | | | | | | | | | | | | x | | | | | | | | | x | x |
| | | *Calcolare i parametri dei sistemi di antenna e progettare le antenne più idonee per una data applicazione* | | | | | | | | | | | | | | | | | x | x | | | | | | | | | | x | x |
| | | *Progettare e validare tecniche di elaborazione e di trasporto dell'informazione multimediale su rete eterogenea* | | | | x | | | | | | | | | | | | | | x | | | | | | | | | | x | x |
| Aspetti metodologici e tecnologici dell'Ingegneria Elettronica (quadro A4.b.2 della SUA-CdS) | Conoscenza e capacità di comprensione (knowledge and understanding) insieme di fatti, principi, teorie e | *Dispositivi e circuiti per l'elettronica analogica* | | x | | | | | | | | | | | | | x | | | | | | | | | | | | | x | x |
| | | *Architettura per l'elettronica digitale;* | | x | | | | | | | | | | | | x | x | | | | | | | | | | | | | x | x |
| | | *Elettronica digitale programmabile* | | x | | | | | | | | | | | | x | x | | | | | | | | | | | | | x | x |
| | | *Elettronica per le reti wireless* | | | | | | | | | | | | | x | x | x | | | | | | | | | | | | | x | x |
| | | *Elaborazione elettronica di segnali e immagini* | x | | | | | | | | | | | | | | x | | | | | | | | | | | | | x | x |
| | | *Sistemi elettronici di potenza* | | | | | | | | | | | | | | | x | | | | | | | | | | | | | x | x |
| | Conoscenza e capacità di comprensione applicate (applying knowledge and understanding) azioni e procedimenti la cui | *Progettare reti elettroniche analogiche e digitali* | | x | | | | | | | | | | | | x | x | | | | | | | | | | | | | x | x |
| | | *Programmare dispositivi FPGA o diversi livelli di astrazione* | | | | | | | | | | | | | | x | x | | | | | | | | | | | | | x | x |
| | | *Progettare filtri digitali lineari, definendo opportune architetture realizzative* | x | | | | | | | | | | | | | | | | | | | | | | | | | | | x | x |
| | | *Progettare catene di acquisizione, elaborazione e visualizzazione di immagini per specifiche applicazioni* | x | | | | | | | | | | | | | | | | | | | | | | | | | | | x | x |
| | | *Progettare e realizzare tecniche di elaborazione e analisi di immagini* | x | | | | | | | | | | | | | | | | | | | | | | | | | | | x | x |
| | | *Dimensionare e controllare convertitori elettronici statici* | | | | | | | | | | | | | | | | x | | | | | | | | | | | | x | x |
| Aspetti teorici, metodologici e tecnologici nell'ambito Robotica e dell'Intelligenza artificiale (quadro A4.b.2 della SUA-CdS) | Conoscenza e capacità di comprensione (knowledge and understanding) insieme di fatti, principi, teorie e pratiche | *L'ottimizzazione matematica continua e discreta* | | | | | | | | | | x | | | | | | | | | | | | | | | | x | | x | x |
| | | *La teoria dei sistemi dinamici con particolare riguardo alla nozione di sistema, alle sue rappresentazioni matematiche e alle sue proprietà strutturali, associata alle nozioni di stato, equilibrio, stabilità e retroazione* | | | x | | x | | | | | | | x | | | | | | | | x | | | | | x | | | x | x |
| | | *L'analisi e la sintesi di sistemi di controllo e la teoria del controllo ottimo e robusto* | | | x | | | | | | | | | | | | | | | | | | | | | | x | x | | x | x |
| | | *Le principali tecniche di apprendimento automatico ed ottimizzazione evolutiva e le metodologie di valutazione dei sistemi basati su queste tecniche* | | | | | | | | | | | | | | | | | | | | | | | | | x | | | x | x |
| | | *I principi di funzionamento dei robot e delle loro componenti meccaniche* | | | | | | | | | | | | x | | | | | | | | | | | | | | | | x | x |
| | | *Le caratteristiche dei sistemi ad agenti e le tecniche di apprendimento automatico basato su rinforzo* | | | | | | | | | | | | | | | | | | | | x | | | | | x | x | | x | x |
| | | *Le nozioni relative alla formazione dell'immagine e le tecniche di visione artificiale per la rilevazione dei punti chiave, degli oggetti ed il loro tracciamento* | | | | | | | | | | | | | | | | | | | x | | | | | | | | | x | x |
| | | *I principi di funzionamento di internet, gli aspetti tecnici relativi agli attacchi informatici e i meccanismi difensivi* | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | x |
| | Conoscenza e capacità di comprensione applicate (applying knowledge and understanding) azioni e procedimenti la cui padronanza è ritenuta indispensabile per applicare le conoscenze e | *formulare modelli matematici, progettare e implementare metodi quantitativi e strumenti software per risolvere problemi decisionali complessi ed identificarne le soluzioni ottime (o sub-ottime)* | | | | | | | | | | x | | x | | | | | | | | | | | | | | | x | | x | x |
| | | *riconoscere le caratteristiche di un sistema dinamico in fenomeni di ambiti vari quali elettrotecnico, informatico, elettronico, meccanico, chimico, biologia* | | | x | | x | | | | | | | x | | | | | | | | | | | | | | | x | | x | x |
| | | *analizzare sistemi dinamici per indagarne il comportamento, avvalendosi di strumenti sia analitici che numerici* | | | x | | x | | | | | | | x | | | | | | | | x | | | | | | | x | | x | x |
| | | *progettare sistemi di controllo a retroazione dello stato o dell'uscita e sistemi di controllo ottimo* | | | x | | | | | | | | | | | | | | | | | | | | | | x | x | | x | x |
| | | *applicare i principali paradigmi dell'analisi di robustezza a sistemi caratterizzati da incertezza di modello* | | | x | | | | | | | | | | | | | | | | | | | | | | | | | x | x |
| | | *valutare quando un problema è risolvibile con tecniche di apprendimento automatico, darne una formulazione astratta, progettare, realizzare e valutare sperimentalmente la soluzione basata su apprendimento automatico* | | | | | | | | | | | | | | | | | | | | | | | | | x | x | | x | x |
| | | *effettuare un'analisi cinematica di un robot* | | | | | | | | | | | | x | | | | | | | | | | | | | | | | x | x |
| | | *identificare un sistema atto ad essere modellato come sistema dinamico e individuare le più adatte tecniche di reinforcement learning* | | | | | | | | | | | | | | | | | | | | | | | | | x | | | x | x |
| | | *riconoscere un problema di visione artificiale e caratterizzarlo, identificare le tecniche più appropriate per risolverlo e progettare e realizzare una soluzione basata su di esse* | | | | | | | | | | | | | | | | | | | | x | | | | | | | | x | x |
| | | *analizzare sistemi di reti di calcolatori, valutarne i punti di debolezza in termini di sicurezza informatica e progettare e realizzare le relative contromisure* | | | | | | | | | | | | | | | | | | | | | | | | | | | | x | x |
| Competenze trasversali *(quadro A4.c della SUA-CdS)* | Autonomia di giudizio (making judgements) | *Attività di Tirocinio* | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| | | *Attività relativa alla tesi di laurea magistrale* | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| | Abilità comunicative (communication skills) | *Esami di profitto* | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| | | *Attività di Tirocinio* | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| | | *Attività relativa alla tesi di laurea magistrale* | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| | Capacità di apprendere (learning skills) | *Esami di profitto* | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| | | *Attività di Laboratorio* | x | | x | | | | | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | |
| | | *Attività di Tirocinio* | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |
| | | *Attività relativa alla tesi di laurea magistrale* | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x | x |