Faculty of Science and Technology
Class 25 - Physical Sciences and Technology
Course Guide 2008/09 for Degree in Physics
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Introduction

Physics is a basic science that has as its main goal the discovery of the basic laws of natural phenomena that occur at all length scales, from the cosmos to elementary particles. Characteristic of physics is an investigation method that is based on a dialectic relation between theory and experiment. The ability to shift between these two methodologies is the most characteristic skill of a physicist. In addition to preparing for scientific research (in universities or research institutes), the study of physics provides a solid scientific base, which can be advantageously applied in the worlds of industrial production and the service sector.
The Faculty of Science and Technology at the University of Camerino offers a comprehensive training in Physics, which is divided into three phases.
The first phase corresponds to a three-year Degree in Physics which concludes with the awarding of the first level degree, the *laurea in fisica.*. There is no requirement for an original thesis, but only a brief dissertation (the *tesina*).
The name of the second level degree is *laurea magistrale*. It lasts two years and can be

studied after the first level degree This second degree concludes with a genuine thesis involving original contributions from the student with an average duration of around 9 months to 1 year. This degree gives access to higher level job positions and is a prerequisite for any further continuation of studies.

Students who wish to pursue further studies, in the third phase can choose a Professional Master degrees (typically lasting one year), a Specialized School (for example, the School of Specialization in Health Physics of four years duration, or that for teaching in high schools, SSIS) or a course of Doctoral Research. Every year at the University of Camerino a Doctorate in Physics (three-year) is offered, and also quite a few Masters degrees which are open to graduates in Physics (the ones offered are different from year to another).
All teaching activities in courses of study carry a value that is rated in credit points. For the first degree 180 credits are required, while for the second degree a total 300 are needed (including those from the first degree).

Prerequisites

Eligible to register are students who have completed the upper-level middle school diploma or equivalent foreign qualification. The degree course assumes knowledge of basic mathematics (in the fields of Algebra, Geometry and Trigonometry) and training in developing logic-deductive ability, abstraction and empirical observation. In each case there is an orientation interview which may result in a requirement to take supplementary courses.

Educational Goals

The graduate in Physics at the University of Camerino, the *laurea in fisica* will be able to:

1. Knowledge of and ability for understanding	Understand the most important physics theories, a knowledge of their logical structure, the experimental results that support them and physical phenomena they described.
	Knowledge in depth of classical physics and the fundamental elements of quantum physics, the structure of matter and nuclear physics.
2. Knowledge of and ability for applied understanding	Solve problems in physics, knowing how to assess the importance of the various active phenomena and to know how to draw analogies so as to apply known techniques to new situations.
	Be familiar with the main experimental techniques, be able to perform measurements completely independently, and to critically analyse and evaluate experimental data.
	Use the main mathematical tools and numerical methods to perform calculations independently, also using development and adaptation of software.
3. Independent judgement	Identify the key elements of a physical process and create a model with which to work.

	Work in a group and fit in quickly in the workplace.
4. Communication skills	Present the results of research activities or a library search to both a specialized audience and to the general public.
	Use written and oral English effectively, both at a technical level and also for the exchange of general information.
5. Ability to learn	"Learn", that is acquire knowledge in new fields through self-study.
	Conduct bibliographic research in physics and to use the results to develop a project.

To achieve these objectives set out above, the training for the undergraduate degree in Physics includes educational activities designed:
• to acquire basic knowledge in the various fields of physics, and the methods of physics as a whole;
• to acquire basic knowledge in mathematics, information science and chemistry;
• to acquire the ability to model natural phenomena and technological problems;
• to learn the main experimental techniques, and learn to perform completely independent measurements and critically analyze data

Employment areas for graduates and professional job opportunities

Graduates of the undergraduate degree in Physics find positions in the Labour Market:

-- In the fields of industry, finance, services and public administration, carrying out technical tasks or professional support in the following areas: acquisition and processing of data in the laboratory; monitoring and diagnostics in medical, health and environmental activities or related to energy savings, or conservation and restoration in the field of cultural heritage (*beni culturali)*; analysis and financial management, optimization of human resources, equipment, materials production and socio-economic processes; modelling and numerical simulation of decision making; definition and management of industrial systems reliability and quality control, automation of industrial and production processes;

-- In the fields of training, learning and dissemination of scientific culture, for example as a university professor or a teacher at secondary, post-secondary and technical schools;

Those who graduated majoring in Technology for Innovation are in a position to take up professional appointments in the fields of development and production process control. Its range includes:
• monitoring and control of production processes
• feasibility studies, testing and certification of processes, tools and equipment
• validation and optimization of industrial processes
• installation, testing and maintenance of complex equipment
• quality control, identification of items to be checked, range of tolerance, methods of control
• issues related to the various stages of production, of acquisition and checking of raw

materials, of subsequent processing, of storage
• carrying out verification techniques

Based on experience, graduates in physics find, in general, stable employment in a short time after the second level of higher education. There is limited information on employment prospects of graduates in physics after the first degree, in fact in the past, the majority of students continued their studies through to the second level. However a limited percentage, of the order of 10-20%, found employment in industry (information technology, electronic, mechanical and chemical sectors), a small percentage found employment in local institutions and in the tertiary sector.

ISTAT codes of the professions:

2.1.1.1 - Physicists and astronomers
2.6.1.1 - University teachers in science: statistics, mathematics, physics, chemistry and earth science
2.6.2.0 - Researchers, graduate and diploma technicians
2.6.3 – Teachers at secondary school, post-secondary and technical colleges
3.1.1 – Technicians of quantitative science, physics and chemistry
3.1.4 - Technicians and operators of optical equipment, electronic and technical
3.1.5 – Technicians of safety science, of environmental protection and of industrial quality
3.3.2.1 - Financial management technicians

Organization of the Teaching Program

The acquisition of skills and knowledge by students is recorded as university credits (CFU). Credits represent the task of learning, including individual study, practice exercises and laboratory work, that required to be done by the student for the first degree in Physics.

The average amount of work in a year for a student engaged in full-time university studies and in possession of adequate initial preparation is fixed at 60 credits. To attain the degree in Physics the student must have gained 180 credits.

Normally the program of individual learning activities maintains a consistency in the ratio of around 1 / 3 between the time devoted to assisted teaching activities and the time spent studying individually. The organisation of the Degree in Physics into six semesters and its overall duration (three years) and are only indicative, serving as a reference for the organization of the teaching and for calculating the number of credits. Students can earn these credits and attain the degree in less than three years.

A credit is a standard load of 25 hours of work. A purely indicative qualification, a credit could correspond to 7 hours of classroom lectures, or 6 hours of lectures with an additional of 2 hours of practice exercises. These values may vary depending on the type of teaching. In laboratory courses instead about 50% of the face to face teaching hours is devoted to practical exercises in the laboratory, for which a credit approximately corresponds to 12 hours of directed activities.

All activities leading to the acquisition of credits must be evaluated. The assessment is carried out by special committees chaired by the Chairman of the educational activity. The assessment tests can be conducted in writing and / or orally, or other procedures suited to a particular type of activity. Also taken into account can be any evidence verifying gain, for which participation is optional for the student and for which any negative result will not preclude admission to the final exam. For courses broken up into modules, evidence verifying gain can be determined at the end of each module. Unless otherwise indicated, learning activities are evaluated by a mark out of thirty, with the possibility of the additional recognition of "*lode*" (with praise). For the allocation of credits for work experience or internship, verification of attendance is required and a report on the activities countersigned by the teacher / supervisor. The evaluation can be expressed with only two possible grades: "satisfactory" or "not satisfactory".

Teaching is divided into 2 semesters according to the following calendar:
Teaching for Semester I: 1 October 2008 to 30 January 2009
Session I Exams: February 2 to February 28, 2009
Teaching for Semester II: March 2, 2009-June 12, 2009
Session II Exams: June 15 to July 31, 2009
Session III Exams: September 1 to October 3, 2009

The number of credits recognised for the teaching activities of the student's choice is ratified by the Class Advisory Board ("consiglio di classe"); such activities may include, in addition to formal university courses, independent study activities (including in that case the frequency of regular seminar series) provided that they are approved by the Class Advisory Board and that they are adequately documented in the way set out by the Board.

The Class Advisory Board can recognize learning activities from other courses of study, including at other universities, or skills and knowledge of the type indicated in paragraph 7 of Article 5 of Ministerial Decree 509/99. In order to encourage good motivated students to enrol for the Degree in Physics, there is the opportunity for recognition of credits for studies undertaken before enrolment in the same course or before commencement of the related learning activities. In particular there will be recognition of no more than 3 credits for study projects agreed to between the scholastic institution where the student came from and the Class 25 Advisory Board, in cases there exists an agreement between the University and the other institution.

Course interviews and integration courses

All students enrolling in the Degree in Physics have the opportunity to attend a course interview that is usually held in the last week of September. The interview is intended to recommend to enrolling students, when deemed necessary, integration courses useful in filling in any gaps in knowledge of basic mathematics. These courses are organized by the service Mentors of the University ("*Tutorato di Ateneo*") and are held immediately before the start of classes between the end of September and beginning of October.

Exemption from fees

Students enrolling for the first time in the Degree in Physics Class 25 are completely exempt from paying the first instalment of tuition fees. To maintain the exemption at the time of payment of the second instalment, the student must have successfully completed at least one exam with a mark of at least 25/30. To maintain the exemption for the second year (November 5), the student must have successfully completed at least 50% of the credits provided by the plan of study with a mark of at least 25/30. Finally, to maintain the exemption for the third year (November 5), the student must have successfully completed at least 65% of the credits provided by the plan of study with an average mark of at least 25/30. Those students who, based on family income, are in the 4th band (income statement certified by ISEE exceeding 32000 Euros annually) are excluded from this exemption.

Mentoring

A mentoring service is provided whose aim is to remove any obstacles to the educational advancement of the student, to provide assistance of a personal nature to overcome problems of settling in and integrating into a new learning environment, and to provide guidance for the overcoming knowledge gaps in the basic skills.

In particular, a support tutor with pre-set publicised consultation hours will be available for students in the Department of Physics to resolve any organizational or logistical problems, and to explain activities and initiatives promoted by University of Camerino.

There will also be mentoring group meetings, to keep track of teaching activities and to bring forward any criticisms. Additional meetings can meet particular needs or requests, and provide information on: i) optional learning activities from degree courses other than the 25 class, but available and potentially useful to 25 Class students ii) the service Internships & Placements ("*Stage & Placement*"); iii) the international program for student mobility.

Internships and traineeships

The internship/traineeship in the third year are to be made at a research laboratory, possibly outside the University of Camerino, in a laboratory or a company. In this last case, the internship must be chosen from among those approved by the Class Advisory Board and listed on the web database, https://vela.unicam.it/stageunicam//bancadati_HM.asp.

Features of the final exam

The candidate shall prepare a review type dissertation on a topic agreed to by one of the teachers of the degree. The candidate must then conduct a discussion in front of the Degree Board which will evaluate the candidate's ability to carry out independent study. The degree mark, given as a percentage plus the possibility of the label "*lode*" (cum laude, with praise), will depend on the student's curriculum, on the preparation and scientific level attained at the completion of studies. To determine the degree mark at the end of the

exam, the Board first evaluates the actual work completed assigning a mark out of 30. Then the Board determines the degree mark using the following procedure:
• the weighted average is calculated of all the marks out of 30 obtained in training activities, including the mark just obtained for actual work completed, and training activities carried out during the three-year degree, using the Credit Units as the weighting factor;
• the weighted average is transformed into a percentage
• this percentage is multiplied by a coefficient associated with the duration of the student's academic career;
• to this is added the product of 0.05 times the number of credits attained “con lode” (with praise);
• the result of this is represented as an integer percentage, by adding 0.5 and then retaining only the integer part;
• if the mark so obtained is at least 111, the committee may assign the label “*lode*”, but only if they unanimously agree.

Educational Curricula

In the 2007-2008 academic year there will be two courses for the Degree in Physics: the Physics course of the Department of Physics of the University of Camerino and the Technologies for Innovation course, the training for which will be conducted at the Centre for World Poetry (“*Centro Mondiale della Poesia*”), Via Santo Stefano, 62019 Recanati (MC).

Degree in Physics, course PHYSICS (“*FISICA*”)

This course is particularly suitable for those who intend to continue studies in fundamental physics and applications, and prepares the student for immediate entry into the work force.

Presented in detail below is the organization of the different subjects, listing the discipline areas and types of subjects, the divisions into modules, and the number of credits awarded.

The tables present the standard curriculum. However note that, having completed the first year examinations, the student may submit by July 31 for approval by the Class Advisory Board individual curriculum for the following academic year, proposing learning goals other than those proposed in the standard curriculum. The Class Advisory Board is committed to assisting students in development of alternative curricula.

TEACHING ACTIVITIES YEAR I classe 25 – PHYSICS						
N	Teaching activity	Credits	Modules	Credits per SSD	Typology (a,b,c,d,e,f)	
1	Mathematical Methods for Physicists I	11		MAT/05	a	Votation
2	Geometry	10		MAT/03	c	Votation

3	General Physics I	10		FIS/01	b	Votation
4	Experiments of Physics I	10		FIS/01	b	Votation
5	Computer science	10	Basic computer science	INF/01	a (5)	Votation
			Lab of computer science	INF/01	a (5)	
6	Thermodynamics	5		FIS/01 (4) CHIM/03 (1)	b (4) c (1)	Votation
7	English	9		L-LIN/12	e (5) f (4)	Votation

TEACHING ACTIVITIES YEAR II **classe 25 – PHYSICS**						
	Teaching activity	Credits	Modules	Credits per SSD	Typology (a,b,c,d,e,f)	
8	Analytical mechanics	10	Differential equations	MAT/05	c (5)	Votation
			Analytical mechanics	MAT/07	c (5)	
9	Chemistry	5		CHIM/03	c	Votation
10	General Physics II	10		FIS/01	b	Votation
11	Mathematical Methods for Physicists II	10		FIS/02	b	Votation
12	Experiments of Physics II	10		FIS/01	g	Votation
13	Modern Physics	10	Wave phenomena	FIS/01	b (5)	Votation
			Wave mechanics	FIS/03	f (5)	

TEACHING ACTIVITIES YEAR III **classe 25 – PHYSICS**						
	Teaching activity	Credits	Modules	Credits per SSD	Typology (a,b,c,d,e,f)	

14	Statistical Physics	5		FIS/02	d	Votation
15	Quantum Mechanics	10		FIS/02	b	Votation
16	Experiments of Physics III	10		FIS/01	g	Votation
17	Physics of Matter	10		FIS/03	b	Votation
18	Nuclear and Subnuclear Physics	10		FIS/04	b	Votation
	Stage	5			f	Idoneity
	Final Exam	5			e	Votation
	Free choice activities	5			d	Votation of idoneity

TABELLA 2: LIST OF TEACHING ACTIVITIES class 25 – PHYSICS – a.a. 2008/2009

N.	Teaching activity	Sector of activity	Teacher		Teacher sector	Year	Semester			Typology	Propedeucity	Hours and type of activity			Estimated Personal study	Total credit si
			Name Surname							(1)	(2)	Lz	L	E		
1	Mathematical Methods for Physicists I	MAT/05	Pierbiagio Pieri	CAM	FIS/03	1	I	CD		a		66		22	187	11
2	Geometry	MAT/03	Stefano Isola	CAM	MAT/07	1	II	Mut.		c		60		20	170	10
3	General Physics I	FIS/01	Irene Marzoli	CAM	FIS/03	1	I+II	CD		b		60		20	170	10
4	Experiments of Physics I	FIS/01	Antonio di Biasio	CAM	FIS/03	1	I	CD		b		42	48		160	10
5	Computer science	INF/01	Leonardo Pasini (5) Roberto Gunnella(5)	CAM	 FIS/03	1	II	Mut CD		a		28 21	 24	12	165	10
6	Thermodynamics	FIS/01 CHIM/03	Umberto Marini Bettolo	CAM	FIS/03	1	II	CD		b(4) c(1)		30		10	85	5
7	English	L-LIN/12	Sheila Beatty	CAM		1	I+II			e(5) f(4)			108		117	9
8	Analytical Mechanics	MAT/05 MAT/07	Giorgio Mancini(5) Giovanni Giacchetta(5)	CAM	FIS/01 MAT/07	2	I	CD CD		c	1,3	30 30		10 10	170	10
9	Chemistry	CHIM/03	Adriana Lorenzotti	CAM	CHIM/03	2	I	CD		c		30		10	85	5
10	General Physics II	FIS/01	Sergio Stizza	CAM	FIS/01	2	I	CD		b	3	60		20	170	10

11	Mathematical Methods for Physicists II	FIS/02	David Vitali	CAM	FIS/03	2	II	CD		b	1,8	60		20	170	10
12	Experiments of Physics II	FIS/01	Sergio Stizza	CAM	FIS/01	2	II	CD		g	4	42	48		160	10
13	Modern Physics	FIS/01 FIS/03	Sergio Stizza(5) Andrea di Cicco (5)	CAM	FIS/01 FIS/03	2	II	CD CD		b(5) f(5)		30 30		10 10	170	10
14	Statistical Physics	FIS/02	Umberto Marini Bettolo	CAM	FIS/03	3	I	CD		d	6	30		10	85	5
15	Quantum Mechanics	FIS/02	Paolo Tombesi	CAM	FIS/03	3	I	CD		b	11,13	60		20	170	10
16	Experiments of Physics III	FIS/01	Nicola Pinto	CAM	FIS/01	3	I	CD		g	12	42	48		160	10
17	Physics of Matter	FIS/03	Giancarlo Strinati	CAM	FIS/03	3	II	CD		b	15	60		20	170	10
18	Nuclear ans subnuclear Physics	FIS/04	Giovanni Lo Bianco	CAM	FIS/01	3	II	CD		b	15	60		20	170	10
	Energy, environment, and renewable energy sources	FIS/03	Nicola Pinto	CAM	FIS/01	1	II	CD		d		28		12	85	5
	Stage					3	II			f					125	5
	Final Exam					3				e					125	5

(1) a) introductory course b) core course c) supplementary course d) elective course e) for the final exam and for knowledge of a foreign language f) other (additional language skills, computer skills, internship/work experience stage etc.)

(2) the numbers given refer to column 1 for each course. They specify the exams which must already have been passed. No number means there are no prerequisites..

(3) this column gives for each course the number of hours devoted to classroom lectures and the number devoted to exercises in the classroom or in the laboratory. The letter L indicates exercises in the laboratory. The letter E indicates exercises in the classroom. The letters Lz indicate classroom lectures.

(4) Amount of time that should be devoted to study or other individual learning activity.

(5) CD = teaching load; A = expected; S = substitute; C = contract

Degree in Physics, course TECHNOLOGIES FOR INNOVATION

This curriculum aims at forming a professional figure

- able to use new technologies for the continuous innovation of processes and products in industries and services;
- with *problem finding* and *problem solving* capabilities, i.e., able to use its knowledge in a creative way in order to individuate obstacles and strategies to overcome them;
- able to immediately introduce himself/herself in the job market, with professional abilities able to complement those of engineers.

Maximum number of enrolled students

The maximum number of students enrolled for the course of Technologies for Innovation for the academic year 2008/2009 is **30 (thirty).** The first 30 students which will have completed all the registration formalities will be enrolled.

Domande di immatricolazione

The request for enrolling at the course of Technologies for Innovation, which is valid also for the admission at the test for the assignment of the excellence grants, must arrive at the Student Office (*Area Gestione Processi Formativi – Segreterie Studenti UNICAM*) within **November, 5 2008**. The presentation of the request for enrolling doesn't jeopardize the possibility to enroll to other Courses with admission test.

Tabelle delle attività formative

Presented in detail below is the organization of the different subjects, listing the discipline areas and types of subjects, the divisions into modules, and the number of credits awarded.

Starting from the academic year 2007/08, the Course on Technologies for Innovation has been significantly modified. For the academic year 2008/09 the new regime will involve only the first and second year, while the third year will keep the old structure. The following tables show the teaching activities which will be held in the academic year, but they show for completeness also the whole structure over the three years of the renewed course.

The tables present the standard curriculum. However note that, having completed the first year examinations, the student may submit by July 31 for approval by the Class Advisory Board individual curriculum for the following academic year, proposing learning goals other than those proposed in the standard curriculum. The Class Advisory Board is committed to assisting students in development of alternative curricula.

TEACHING ACTIVITIES YEAR I **class 25 – TECHNOLOGIES FOR INNOVATION**						
N	Teaching activity	Credits	Modules	Credits per SSD	Typology (a,b,c,d,e,f)	
1	Calculus	15	Calculus I	MAT/03	a (5)	
			Calculus II +III	MAT/05	a(10)	

2	Elements of Chemistry	10	Elements of Chemistry I	CHIM/03	c (6)	
			Elements of Chemistry II	CHIM/06	c (4)	
3	Computer programming	10		INF/01	a	
4	Elements of Physics	14	Mechanics and Thermodynamics	FIS/01	b (9)	
			Measurement Methods	FIS/01	g(5)	
5	Aesthetics of the industrial product	4		ICAR/13	c	
6	English	9		L-LIN/12	e(5) f(4)	

TEACHING ACTIVITIES YEAR II **class 25 – TECHNOLOGIES FOR INNOVATION**						
	Teaching activity	Credits	Modules	Credits per SSD	Typology (a,b,c,d,e,f)	
7	Experimental Physics	10		FIS/01	b	
8	Measurement Techniques	5		FIS/01	g	
9	Applied Mathematics	5		FIS/02	b	
10	Polymer Chemistry	7	Polymer Chemistry I	CHIM/05	c (4)	
			Polymer Chemistry II	CHIM/05	c (3)	
11	Material Science	10	Material Science I	FIS/03	b (5)	
			Material Science II	FIS/03	b (5)	
12	Modern Physics	10		FIS/03	b (5)	
				FIS/03	b (5)	
13	Technologies for material transformations	5		CHIM/07	d	
14	Computer architecture	5		ING-INF/05	c	

TEACHING ACTIVITIES YEAR III (valid starting from academic year 2009/10) **class 25 – TECHNOLOGIES FOR INNOVATION**						
	Teaching activity	Credits	Modules	Credits per SSD	Typology (a,b,c,d,e,f)	
15	Data acquistition technologies	8		FIS/01	b	

16	Electronic circuits and devices	8		FIS/01	b	
17	Economy and management	10		ING-INF/05	c (5)	
				SECS-P/08	c (5)	
18	Technologies for the control of processes	10		ING-INF/04	g	
19	Sensors	5		ING-IND/12	c	
20	Advanced material diagnostics	5		CHIM/01	d	
	Stage	10			f	
	Final exam	5			e	

TEACHING ACTIVITIES YEAR III (valid only in the academic year 2008/09) **class 25 – TECHNOLOGIES FOR INNOVATION**

	Teaching activity	Credits	Modules	Credits per SSD	Typology (a,b,c,d,e,f)	
	Management	4		SECS-P/08	c	
	Logistical management	5		ING-INF/05	c	
	Measurement techniques	10	Measurement techniques 1	CHIM/01	g (5)	
			Measurement techniques 2	CHIM/01	g (5)	
	New material technologies	10	New materials	ICAR/13	c (5)	
			Sensors	ING-IND/12	c (5)	
	Material science	10	Metallic materials	FIS/03	b	
			Physical technologies	FIS/04	b	
	Stage	10			f	
	Final exam	5			e	

TABELLA 2: LIST OF TEACHING ACTIVITIES class 25 – TECHNOLOGIES FOR INNOVATION – a.a. 2008/2009

N.	Teaching activity	Sector of activity	Teacher		Teacher sector	Year	Semester			Typology	Propedeucity	Hours and type of activity			Estimated Personal study	Total credits
			Name Surname							(1)	(2)	Lz	L	E		
1	Calculus	MAT/03 MAT/05	(5) (10)	REC		1	I+II	C C		a		30 60		10 20	255	15
2	Elements of Chemistry	CHIM/03 CHIM/06	Rossana Galassi (6) Enrico Marcantoni (4)	REC	CHIM/03 CHIM/06	1	I	CD CD		c		36 24		12 8	170	10
3	Computer programming	INF/01		REC		1	I	C		a		42	48		160	10
4	Elements of Physics	FIS/01	Massimo Conti	REC	FIS/06	1	II	CD		b (9) g (5)		84		28	238	14
5	Aesthetics of the industrial products	ICAR/13		REC		1	II	C		c		32			68	4
6	English	L-LIN/12		REC		1	I+II	C		e(5) f(4)			108		117	9
7	Experimental Physics	FIS/01		REC		2	I	C		b	1,4	60		20	170	10
8	Measurement techniques	FIS/01	Massimo Conti	REC	FIS/06	2	I	CD		b	1,4	21	24		80	5
9	Applied Mathematics	FIS/02	Stefano Mancini	REC	FIS/02	2	I	CD		b	1	30		10	85	5
10	Polymer Chemistry	CHIM/05	Enrico Marcantoni (4) (3)	REC	CHIM/06	2	I	CD C		c		24 18		8 6	119	7

11	Material Science	FIS/03	Fabio Marchesoni (5)	REC	FIS/03	2	II	CD C		b	4	30 30		10 10	170	10
12	Modern Physics	FIS/03	Fabio Marchesoni	REC	FIS/03	2	II	CD		b	9	60		20	170	10
13	Technologies for material transformation	CHIM/07		REC		2	II	C		d	2	30		10	85	5
14	Computer architectures	ING-INF/05		REC		2	II	C		c	3	30		10	85	5
15	Logistical management	ING-INF/05		REC		3	I	C		c		30		10	85	5
16	Management	SECS-P/08		REC		3	I	C		c		32			68	4
17	New material technologies	ICAR/13 ING-IND/12	M. Conti (5) (5)	REC		3	I	CD C		c		21 21	24 24		160	10
18	Measurement techniques	CHIM/01	Francesco Nobili (5) Rita Giovannetti (3) Filippo Pucciarelli (2)	REC	CHIM/01 CHIM/12 CHIM/12	3	I	CD		g		21 14 7	24 12 12		160	10
19	Material Science (old)	FIS/03 FIS/04	(5) Massimo Conti (5)	REC	FIS/06	3	II	C CD		b		21 21	24 24		160	10
	Elements of quantum mechanics	FIS/03	Fabio Marchesoni	REC	FIS/03	3	II	CD		d		30		10	85	5
	Applied genetics	BIO/18	A. Giuliodori	REC	BIO/18		II	CD		d		30		10	85	5
	Criminology	IUS/17		REC			II	C		d		30		10	85	5
	Technical design	ICAR/13		REC			I	C		d		30		10	85	5
	Stage					3	II			f					250	10
	Final exam					3				e					125	5