UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

COURSE OF STUDY: Dentistry and Dental Prosthetics (LM46)
ACADEMIC YEAR: 2024/2025
ACADEMIC SUBJECT: Applied Physics (6 CFU/ETCS), module of the integrated course Physics and Informatics (10 CFU/ECTS)

General information	
Year of the course	1st
Academic calendar (starting and ending date)	1st semester (17/10/2024 – 23/01/2025)
Credits (CFU/ETCS):	6
SSD	FIS/07 - Applied Physics
Language	Italian
Mode of attendance	Mandatory

Professor/ Lecturer	
Name and Surname	Raffaele Tommasi
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Department and address	Dipartimento di Biomedicina Traslazionale e Neuroscienze (DiBraiN) Nuovo Complesso delle Scienze Biomediche (2nd floor) Policlinico – Piazza G. Cesare 11, I-70124 Bari
Virtual room	Microsoft Teams (code: m5brvz3)
Office Hours (and modalities: e.g., by appointment, online, etc.)	Mon-Fry, by appointment

Work schedule			
Hours			
Total	Lectures	Hands-on (laboratory, workshops, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
150	60		90
CFU/ETCS			
6	6		

Learning Objectives	The course aims to provide students with a fundamental understanding of general physics and demonstrate its applications in the biological and medical fields. By the end of the course, students will be able to comprehend the concepts and quantities needed to describe physiopathological events in the human body. Additionally, students will develop the skills to apply the scientific method in describing and interpreting basic natural phenomena.
Course prerequisites	High-school mathematics.

Teaching strategy	Frontal teaching, also with the use of free and interactive simulations available online.
Expected learning outcomes in terms of	
Knowledge and understanding on:	Acquisition of the theoretical and experimental foundations of classical physics; initiation to the understanding of the scientific method, the nature, and methods of research in physics.

Applying knowledge and understanding on:	The ability to identify the essential elements of a phenomenon, in terms of order of magnitude and necessary level of approximation; ability to apply laws and theories to concrete situations aimed at problem-solving.
Soft skills	• *Making informed judgments and choices:* the ability for independent reasoning to recognize the physical laws governing the behavior of observed phenomena and to solve both standard and non-standard problems. • *Communicating knowledge and understanding:* the ability to express oneself in a scientifically rigorous manner and to communicate one's knowledge during examination tests. • *Capacities to continue learning:* learning basic concepts and consolidating logical and scientific skills useful for further studies.
Syllabus	
Content knowledge	• Introduction: definition of a physical quantity and its dimensions; systems of measurement units and fundamental constants; dimensional equations; multiples and submultiples of measurement units; measurement errors; representation of physical laws. • Scalar quantities and vector quantities: vector addition and subtraction, multiplication and division of vectors, dot product and cross product. • Mechanics: trajectory and time law; position, velocity, and acceleration; uniform rectilinear motion, uniformly accelerated rectilinear motion, uniform circular motion, angular velocity, centripetal acceleration, relative motion reference systems; forces, laws of dynamics, mass, weight, and density, impulse theorem; some particular forces, friction, medium resistance, and speed limit. • Work, energy, and power: kinetic energy and kinetic energy theorem; conservative fields; universal law of gravitation and weight force, gravitational potential energy, elasticity and elastic potential energy, conservation of mechanical energy, center of mass and centroid, conservation of momentum, equilibrium of a rigid body, constraints, and levers. • Fluid Mechanics: fluids, density, and pressure; static fluids, Archimedes' principle, flow rate and continuity equation, Bernoulli's theorem, viscous fluids: laminar flow and turbulent flow; surface tension and elastic tension; gas embolism, capillarity; hydraulic resistance and pressure drop, cardiovascular system, blood hydrodynamic circuit, vessel resistance and pressure variations, cardiac work and power; measurement of arterial pressure; gas embolism, hydrostatic effects and effects of accelerations on arterial pressure, sedimentation, electrophoresis, centrifugation; pulmonary alveoli and mechanics of respiration. • Oscillations and Wave Phenomena: simple harmonic motion, energy of the harmonic oscillator, longitudinal waves and transverse waves, propagation equation of an elastic wave; sound, intensity and sound level, Doppler effect; ultrasound and its use in medicine. • Diffusion and Osmosis: solutions, free diffusion and through semipermeable membranes, osmotic pressure, osmotic phenomena in capillaries. • Thermology and Thermodynamics: temperature and thermodynamic scales, heat, work in thermodynamics, thermodynamic transformations, 1st law of thermodynamics and conservation of energy, ideal gases and real gases, partial pressures, specific heats, changes of state and latent heats, Carnot cycle, 2nd law of thermodynamics, entropy, heat propagation mechanisms, metabolic energy and caloric content of foods, human body thermoregulation. • Electric Phenomena and Bioelectric Phenomena: electric charge and Coulomb's force, quantization and conservation of electric charge, electric field and electrostatic potential, distributions of electric charges, electric

	dipole, equipotential surfaces, electrical capacitance, capacitors in series and parallel, electric current, resistance and resistivity, direct current circuits, resistors in series and parallel, Joule effect, electrolytic solutions, electrochemical fluxes, cell membrane and resting potential, passive and active transport mechanisms, sodium-potassium pump, action potential and its propagation, electroencephalography and electrocardiography, pathogenic actions of currents and brief safety standards. • Electromagnetism: magnetic field, Lorentz force, magnetic force on electric currents, magnetic field flux, electromagnetic induction, magnetic fields generated by electric currents, magnetoencephalography, electromagnetic waves. • Physical Optics and Geometric Optics: electromagnetic waves, reflection and refraction, total internal reflection, optical fibers, images and plane mirrors, spherical mirrors, spherical diopter, thin lenses, image formation, human eye and visual perception, visual defects and their correction using lenses, optical instruments. • Matter and Radiation: spectrophotometry and Lambert-Beer law, atoms and nuclei, nuclides and isotopes, radioactivity, law of radioactive decay; ionizing radiation, computed tomography (CT), positron emission tomography (PET), brief introduction to dosimetry and biological effects of ionizing radiation.
Texts and readings	• J. Walker, D. Halliday, R. Resnick, Fondamenti di fisica 8e – Meccanica, Onde, Termodinamica, Elettromagnetismo, Ottica - Zanichelli, CEA • D. Scannicchio, Fisica Biomedica - EdiSES • P. Davidovits, Physics in Biology and Medicine, 6th Edition, Elsevier • L. Nitti, R. Tommasi, Fisica – 2000 quiz a scelta multipla per le scienze biomediche - Zanichelli, CEA
Notes, additional materials	Lecture slides
Repository	Microsoft Teams (code: m5brvz3)

Assessment	
Assessment methods	The examination for the integrated course consists of partial exams in Applied Physics and Informatics. The Applied Physics exam aims to assess both the student's theoretical knowledge of the course contents and their ability to apply theory to problem-solving. The test is written, consisting of 30 multiple-choice questions and lasts 60 minutes. The use of a scientific calculator is permitted. The number of questions may be proportionally reduced for students who have obtained their CFU/ECTS in other recognized degree courses. The results of the written tests are published on the Microsoft Teams website of the course.
Assessment criteria	• *Knowledge and understanding:* the student should demonstrate an understanding of the fundamental laws of physics relevant to the subjects discussed in the lectures. • *Applying knowledge and understanding*: the student should be able to solve simple physical problems by using the acquired knowledge. • *Making judgments*: the student should be able to follow autonomous reasoning in solving problems. • *Communication skills*: the student should master scientific language related to the course contents. • *Learning skills*: the student should learn to autonomously investigate problems in which the application of physical laws is required.

Final exam and grading criteria	The partial test consists of 30 multiple-choice questions. Each right answer is awarded 1,05 points, while a penalty of 0,25 points is given for each wrong answer; unanswered questions give no contribution to the score. The number of questions can be proportionally reduced for students who have their CFU/ECTS obtained in other degree courses recognized. In this case, the final score is computed as an average, weighted by CFU/ECTS, of the scores obtained in the recognized exam and in the Applied Physics partial test. The test is passed with a score of at least 18 points. The test is passed cum laude with a score greater than 30 points. The final marks of the integrated course are computed as an average, weighted by CFU/ECTS, of the scores obtained in the two partial tests.
Further information	

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COURSE OF STUDY: Dentistry and Dental Prosthetics (LM46)
ACADEMIC YEAR: 2024-2025
ACADEMIC SUBJECT: Informatics (4 CFU/ETCS), module of the integrated course Physics and Informatics (10 CFU/ECTS)

Principali informazioni sull'insegnamento	
Year of the course	I year
Accademic calendar	I semester (oct - jan)
Credits (CFU/ETCS):	4
SSD	INF/01 – Informatics
Language	Italian
Mode of attendance	Mandatory

Professor	
Name and Surname	GIOVANNI COZZOLONGO
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Telephone	0805442195
Department and address	Campus Universitario – via Orabona 4 c/o Uffici del CSI – dip. Di Fisica
Virtual room	https://teams.microsoft.com/l/chat/0/0?users=giovanni.cozzolongo@uniba.it
Office Hours	Lun-mar 16.30 – 17.30 by appointment via teams/email

Organizzazione della didattica			
Ore			
Total	Lectures	Hands-on	Out-of-class/self-study hours
100	*40*	*0*	*60*
CFU/ETCS			
4	4		

Learning Objectives	The course aims to provide students with knowledge of applied computer science, in a way that is useful for turning them into research tools, for the purpose of individual updating, as well as providing basic notions of applied computer science. In particular, through knowledge of the main protocols underlying the Internet, students will develop the ability to use online research tools. Furthermore, they will acquire knowledge of the legislation on the processing of personal data (GDPR) and will be able to use the main office automation software, and in particular those for managing spreadsheets.
Course prerequisites	*The course refers to an exam of the first year, first semester, there are no specific prerequisites different from those required for access to the degree course.*

Teaching strategies	Mainly frontal teaching, with some practical exercises and group work, useful for developing the ability to apply the notions learned, especially with regards to the use of automation and calculation software.

Expected learning outcomes ***specified for each Dublin Descriptor (DD)*** ***DD1*** **Knowledge and understanding**	**- DD1 (knowledge and understanding)**: acquisition of the theoretical foundations of IT; Ability to understand digitalization and the tools needed to achieve it. **- DD2 (ability to apply knowledge and understanding)**: Ability to identify the IT tools necessary to solve a problem and ability to solve it through their use. **- DD3 (critical and judgmental skills)**: possess a level of professional, cultural, decision-making and operational autonomy such as to allow constant updating using IT tools. **- DD4 (ability to communicate what has been learned)**: knowing how to manage

***DD2* Applying knowledge and understanding** ***DD3* Making informed judgments and choices** ***DD4* Communicating knowledge and understanding** ***DD5* Capacities to continue learning**	communications using information technology, and to communicate one's knowledge during exams. **- DD5 (ability to continue studying independently throughout life)**: develop learning skills necessary to undertake further studies with a high degree of autonomy.
Content knowledge (Programma)	• Introduction (history of computing and basic concepts) • binary code and conversions • Hardware and software (central unit, operating systems) • theoretical models • Internet (history, protocols and applications of the network) • network protocols, iso/osi • tcp/ip,routing and addressing,www • dynamic pages and Web 2.0 • Bibliographic research • internet browser, • databases, pubmed, cimedoc… • Digitization • resolutions, compression, storage • digitization errors • DICOM - RIS and PACS • Informative system CAD and process digitalization • GDPR • data protection regulation • rights and duties • data controller • DPO • Introduction to programming • definition and examples of algorithm • structured flowcharts • Artificial intelligence • Definitions, what is machine learning, LLM • Word processing • layout, characters, columns, printing, bibliography, images • Spreadsheet and database • data format, cells, formulas, charts, pivots • Presentations • Power Point: create presentations; manage layout, effects, transitions, videos
Texts and readings	Handouts and notes distributed during lessons.
Notes, additional materials	The handouts can be integrated with any materials available online, which could in some cases be more up to date than the handouts themselves
Repository	

Assessment	
Assessment methods	The integrated course exam consists of partial tests in Applied Physics and Computer Science. The IT test is written and aims to evaluate both the student's knowledge of the course contents and the ability to solve practical questions. The exam is written, composed of a mathematical-logical exercise and two multiple choice questions,

	among which the student will have to identify the correct one, and then justify the answer as if it were an open question. The duration of the test is 30 minutes. The results of the written tests are published on the course's Microsoft Teams site.
Assessment criteria	Knowledge and understanding: to reach a sufficient level the student will have to identify the correct answers, demonstrating that they have understood the main topics. The student will be able to argue the answer showing a deeper level of understanding of the same topics. Applied knowledge and understanding: To reach a sufficient level the student must demonstrate the ability to solve mathematical-logical exercises. Making judgement: The student must demonstrate that they are able to solve the proposed problems efficiently, making use of all the skills acquired Communication skills: to reach a sufficient level, the student must demonstrate sufficient mastery of the relevant scientific terminology. *Learning skills*: at a sufficient level, the student will be able to independently examine, investigate and process problems in which the use of IT tools is required.
Final exam and grading criteria	The Computer Science partial test consists of a mathematical-logical exercise and two multiple choice questions. Each correct answer is rewarded with 6 points; The free response is worth 1 to 5 points. The score considers the quality of the answer, its correctness, its adherence to the question, the ability to summarize, and also the ability to express oneself in the Italian language, taking care of the order if possible. The mathematical-logical exercise is worth 11 points. The final grade is the weighted mean of both tests (Physics and Informatics). The weights are the CFU of each discipline of the C.I.
Further Information	
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