Chemistry [2303103]

Offerta didattica a.a. 2022/2023

Docenti: SARA MARIA GIANNITELLI

Periodo: Primo Ciclo Semestrale

Obiettivi formativi

Specific Learning objectives:
The course provides an overview of general inorganic and organic chemistry.

Specific learning outcomes:

Knowledge and understanding
The course will transfer the following knowledge and understanding to the student:
• the atomic bases of chemistry for the construction of the periodic table of elements and a reasonable prediction about: how and why the atoms react;
• the chemical bond and its correlation with the properties of matter; spontaneity and equilibrium of chemical reactions; the main classes of organic compounds and their reactivity.
The student will be able: to understand the meaning of chemical reaction and to perform stoichiometry calculations; to describe the properties and structure of gas, liquid and solids; to understand the thermodynamic, and kinetic aspects of the chemical transformations.

Applying knowledge and understanding
At the end of the course the student will be able to:
• make predictions on the reactivity of an element based on its position in the periodic table;
• knowing how to write a formula of Lewis structure by sorting the compounds on the basis of the chemical bond and properties;
• to discuss a chemical balance and of the factors that influence the reaction with particular attention to the acid/base balance; to know how to define a species oxidant and reductant;
• know how to define and use the thermodynamic functions;
• how to write formulas of organic compounds and use them to synthesize other.
The student must also be able to solve stoichiometric problems of practical utility (e.g., calculation moles, balance reactions, limiting reagent, yield, definition and ways of expressing concentration, preparation for dilution solutions).

Making judgments
Specific attention will be paid to let the students improve the critical capacity when studying key chemical processes.

Communication skills
The student will develop the ability to describe the subjects which are part of this course syllabus using the right scientific terminology.

Learning skills
The student must be able to study in a manner that may be largely self-directed or autonomous.

Prerequisiti

Basic notions of mathematics and physics.

Contenuti del corso

Introduction remarks: The Scientific Method, Measurements, Scientific Notation, Density, Temperature, Matter and energy, Chemical vs. Physical Changes. (2 hours)
Atoms and Molecules: Dalton's Theory, Bohr Theory, Modern Atomic Theory, Periodic Table, Electronic Structure of Atoms. (6 hours)
Chemical bond: covalent bond, ionic, metallic, Inorganic Nomenclature, hydrogen bond, Electronegativity, Weak interactions. (6 hours)
Chemical Reactions: Mole Concept, Stoichiometry, Types of Reactions, Oxidation-Reduction. (4 hours)
States of Matter: Gas Laws, Intermolecular Forces, Liquids, Solids, Changes of State. (4 hours)
Solutions: Concentration Terms (%w/w, %w/v, v/v %, M, b, N), Colligative Properties. (6 hours)
Chemical Equilibrium: Law of Chemical Equilibrium, K_p, K_c and K_x, van't Hoff Equation, Le Chatelier's Principle.
Solubility Equilibria: Sparingly Soluble Compounds, Net Ionic Equations, K_{ps} Concept and Calculations. (8 hours)

Chemical Kinetics: Concepts, Rate Equations, First Order, Second Order, Half-Life, Rate Constants, Energy Profile Diagrams, Catalysis, Activation Energy. (4 hours)
Chemical Thermodynamics: First Law of Thermodynamics, Internal Energy, Second Law of Thermodynamics, Definition of Entropy, Free Energy G: Definition, Spontaneity. (6 hours)
Acids and Bases: Definitions (Arrhenius, Bronsted-Lowry, Lewis), Weak vs. Strong, Hydrolysis, Neutralization, pH, titrations, buffers (bicarbonate and phosphate buffers). (8 hours)
Nuclear chemistry: radioactivity, decay time, clinical applications. (2 hours)
Electrochemistry: Faraday's Law, Galvanic Cells: Concepts, Cell Diagrams, Anode and Cathode, Half-Cell Reactions and f.e.m. Overall Cell Reactions and emfs, Nernst Equations. (6 hours)

Organic Chemistry: Functional Groups and their main reaction mechanisms, Nomenclature, Structural or spatial arrangements of organic molecules, Main classes of organic compounds. (6 hours)

Metodi didattici

The educational activities and teaching methods listed below, may undergo changes during the entire academic year in compliance with any legal provisions issued.
Face-to-face lectures explaining the contents of the course (78%, approx. 68 hours).
Exercises that show the application to specific problems of the knowledge learned in lectures held online (15%, approx.13 hours).
Laboratory sessions to teach the work in a chemical laboratory, prepare chemical solutions and see the application of written exercises (7%, approx. 6 hours).

Modalità di verifica dell'apprendimento

Knowledge assessment methods and criteria:
Knowledge and skills relating to inorganic chemistry and organic chemistry will be verified by means of a test with multiple choice questions to be carried out on the University's elearning platform. In the test, the Student will have to answer 30 multiple choice questions in 40 minutes. The test will be carried out in the classroom on Student' laptop or in the Multimedia Laboratory of the University. The Student will receive the result of his test as a score expressed in thirtieths.

Criteria for measuring learning and defining the final grade:
In the test, the Student will have to answer 30 multiple choice questions in 40 minutes, of which:
- each question will have 4 answers (A, B, C, D) of which only one is corrected;
- only one answer can be selected for each question;
- points are assigned as follows: 1 (one) point for each correct answer; 0 (zero) points for each incorrect or not given answer.

Each test will be different from the other and assigned randomly by the system. The correction of the test and therefore the score achieved, corresponding to the grade, is made by the e-learning system for comparison with the correct answers loaded on the platform itself. Each Student will receive only his/her results and, therefore, the score he/she has achieved. Each Student will not receive the grade of the other Students. In addition, the Student can re-evaluate his/her test by checking which questions he/she answered correctly and which not, knowing, in this case, the correct answer. At the end of the test, the Commission will be available to the Students to review together the incorrect answers.
The exam is deemed to be passed successfully if the grade is equal to or higher than 18/30 and it will coincide with the final grade if this is less than the maximum score achievable with the test equal to 30/30. Who gets a vote, although sufficient, may decide to repeat the examination in subsequent sessions.
In the event of a full grade (30/30), the student will have the opportunity to try to grant honors (cum laude) through an oral test. The oral test will be carried out immediately after the test result. In the oral test, 1 question will be asked to the Student. This question aims to evaluating the logic followed by the Student in problem solving, the use of an appropriate language in the answer to the question and, also, the adequacy of the proposed solution in relation to the skills that the Student it is assumed that he has acquired at the end of the course. The oral test is worth 3 points. The final grade is calculated adding or subtracting the 3 points of the oral test to the score 30/30 gained by the test. Further skills which will be evaluated encompass making judgements, communication skills and learning skills according with Dublin Descriptors.

Testi di riferimento

Face-to-face lectures and exercises (including exam's tests) are carried out on an electronic whiteboard. The saved whiteboards will be uploaded on the e-learning platform at https://elearning.unicampus.it/.
These whiteboards allow the student to review and deepen the topics covered and transform into knowledge what has been learned in class and into skills and competences what has been done during the exercises.
Teaching materials recommended for independent study by the Student interested in learning more about the discipline:
Whitten, Davis, Peck, Stanley, CHEMISTRY
P. Silvestroni FONDAMENTI DI CHIMICA, CEA casa editrice Ambrosiana
Exercises:
P.M. Lausarot, G.A. Vaglio, STECHIOMETRIA PER LA CHIMICA GENERALE, Piccin

I. Bertini, C. Luchinat, F. Mani, E. Ravera, STECHIOMETRIA VI Ed, CEA casa editrice ambrosiana

Altre informazioni

Knowledge and understanding
The course will transfer the following knowledge and understanding to the student:
• the atomic bases of chemistry for the construction of the periodic table of elements and a reasonable prediction about how and why the atoms react;
• the chemical bond and its correlation with the properties of matter; spontaneity and equilibrium of chemical reactions; the main classes of inorganic compounds and their reactivity.
The student will be able: to understand the meaning of chemical reaction and to perform stoichiometry calculations; to describe the properties and structure of gas, liquid and solids; to understand the thermodynamic, and kinetic aspects of the chemical transformations.

Applying knowledge and understanding
At the end of the course the student will be able to:
• make predictions on the reactivity of an element based on its position in the periodic table;
• knowing how to write a formula of Lewis structure by sorting the compounds on the basis of the chemical bond and properties;
• to discuss a chemical balance and of the factors that influence the reaction with particular attention to the acid/base balance;
• know how to define a species oxidant and reductant;
• know how to define and use the thermodynamic functions;
• how to write formulas of inorganic compounds and use them to synthesize other.
The student must also be able to solve stoichiometric problems of practical utility (e.g., calculation moles, balance reactions, limiting reagent, yield, definition and ways of expressing concentration, preparation of diluted solutions).

Making judgments
Specific attention will be paid to let the students improve the critical capacity when studying key chemical processes.

Communication skills
The student will develop the ability to describe the subjects which are part of this course syllabus using the right scientific terminology.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Ingegneria

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Corso di Laurea	Biomedical Engineering (2022)	comune	7	CHIM/07

Stampa del 13/07/2023

Economics and Management [2303105]

Offerta didattica a.a. 2022/2023

Docenti: FRANCESCO CAPPA

Periodo: Secondo Ciclo Semestrale

Obiettivi formativi

Specific Learning objectives:
The course aims to provide students with the fundamental elements of economics and management to evaluate and take business decisions. We want to deliver an overview of the business management principles from different points of view that comprise: the identification of the different forms of business according to the Civil Code, the examination of the different possible organizational structures, the analysis of operations and marketing decisions within the organization, and the evaluation tools for investment decisions. Specific attention will be devoted to economic and managerial aspects in the Healthcare sector, comprising reference to related regulatory affairs.

Specific learning outcomes:
1) Knowledge and understanding: Ability to analyze and manage business decisions. Understanding of managerial tools and of the characteristics of the main company functions.
2) Applying knowledge and understanding: ability to apply the knowledge acquired through the use of tools for analyzing and processing business choices in different organizational contexts.
3) Autonomy in making judgements: on the basis of the knowledge acquired, and thanks to the use of methodological tools learned during the course, ability to evaluate investments to be started and possible organizational forms to be adopted, for the improvement of organization performance.
4) Communication skills: communication and interpretation skills, processing and synthesis of data relating to business decisions, acquisition of economic-business terminology suitable for the explanation, interpretation and communication of managerial choices.
5) Learning skills: articulated and organic learning skills that will allow the breakdown of problems in consideration of their complexity, the management of effective solutions.

Prerequisiti

There is no mandatory prerequisite but it is strongly suggested to have gained basic knowledge of mathematical concepts.

Contenuti del corso

Module 1 (10 hours). The first module introduces the fundamental concepts regarding business and competition. We will deal with the civil definitions of organizational entities (e.g. definition of enterprise, company and entrepreneur) and the distinction between different legal forms (i.e., sole proprietorships, partnerships and corporations). Then the basics of sustainable development, based on economic, social and environmental sustainability, will be introduced, referring also to all the stakeholders that might be considered by business decisions. Specific reference to the Healthcare sector will be provided.
Module 2 (20 hours). The second module provides an overview of the business system from an organizational point of view. The main organizational forms to support business models and corporate operations will then be illustrated, and the advantages and disadvantages associated with each of them will be discussed. Specific reference to the Healthcare sector will be provided.
Module 3 (10 hours). The third module deals with the fundamentals of marketing, which might be crucial for the success of products and services. The main constituents of marketing decisions will be considered. Specific reference to the Healthcare sector will be provided.
Module 4 (10 hours). The fourth module considers the operations management. The main tools for operations management will be introduced. Specific reference to the Healthcare sector will be provided.
Module 3 (10 hours). The final module introduces tools to evaluate and implement business decisions. First, an introduction to the general principles of financial statements will be considered. Then, the concepts of the time value of cash flows and cost of capital will be introduced. Finally the tools for choosing investments will be considered (i.e., Net Present Value and Payback period). In addition, regulatory affairs related to the Healthcare sector will be covered.

Metodi didattici

The course is based on lectures (50 hours) and exercises (10 hours).

Modalità di verifica dell'apprendimento
Knowledge assessment methods and criteria:
The assessment test is written and will contain a series of questions (multiple-choice and open questions), as well as exercises, aimed at assessing the theoretical and practical knowledge of the topics presented in class.

Criteria for measuring learning and defining the final grade:
The exam scores will be distributed as follows: theoretical part 20 points in total; numerical part 12 points in total. The theoretical part consists of 3 open-ended questions of 4 points each and 8 multiple choice questions.

Testi di riferimento
Slides.
Suggested books:
Essentials of Strategic Management: The Quest for Competitive Advantage, 2020, McGraw Hill.
Corporate Finance, di J. Berk e P. De Marzo 2020, Pearson.

Altre informazioni

1) Knowledge and understanding: Ability to analyze and manage business decisions. Understanding of managerial tools and of the characteristics of the main company functions.
2) Applying knowledge and understanding: ability to apply the knowledge acquired through the use of tools for analyzing and processing business choices in different organizational contexts.
3) Autonomy in making judgements: on the basis of the knowledge acquired, and thanks to the use of methodological tools learned during the course, ability to evaluate investments to be started and possible organizational forms to be adopted, for the improvement of organization performance.
4) Communication skills: communication and interpretation skills, processing and synthesis of data relating to business decisions, acquisition of economic-business terminology suitable for the explanation, interpretation and communication of managerial choices.
5) Learning skills: articulated and organic learning skills that will allow the breakdown of problems in consideration of their complexity, the management of effective solutions.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Ingegneria

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Corso di Laurea	Biomedical Engineering (2022)	comune	6	ING-IND/35

Stampa del 13/07/2023

Fundamentals of Computer Science [2303101]

Offerta didattica a.a. 2022/2023

Docenti: ROSA SICILIA

Periodo: Secondo Ciclo Semestrale

Obiettivi formativi

Specific Learning objectives:
Introduction to the organization and use of a computing system, with special focus on problem solving through computer programming. The student is also introduced to the use of methodologies and environments that enable efficient software development through the generation and reuse of high quality modular components.

Specific learning outcomes:
Knowledge and understanding.
The course will transfer the following knowledge and understanding to the student:
• Knowledge and understanding of basic elements of computer architectures, including distributed systems
• Knowledge of user interfaces for interaction with a computing system
• Knowledge of data representation and storage in computer systems
• Knowledge and understanding of basic principles of Object-Oriented Programming
• Knowledge of one or more programming languages that support modular development and reuse of software in a distributed environment
• Knowledge and understanding of basic algorithms on sequences and multidimensional data structures
• Knowledge of methodologies for software quality assurance and documentation
• Knowledge of tools supporting software development and maintenance

Applying knowledge and understanding.
At the end of the course the student will be able to:
• Manage data and software applications in a standard computing environment
• Understand how to employ reusable software components from available documentation
• Use a programming language to develop modular and reusable software components
• Perform quality control of software components and prepare the documentation required for their reuse
• Manage the development cycle of software components

Making judgments
The knowledge and understanding skills acquired must give the student the ability to evaluate and select, on the basis of the requirements specifications, the most appropriate tools and software components for the development and reuse of modular software. The student will also have the ability to:
• Evaluate the correctness of the proposed algorithm
• Evaluate the appropriateness of the proposed algorithm for solving a given problem

Communication skills
The student will develop the ability to:
• Explain to users how utilize software application they have developed
• Communicate, in a timely and competent manner, the choices made in the development of software applications
• Prepare the documentation aimed at reuse and maintenance of the modular solutions
• Interact with computer science experts for requirements specification of advanced data processing applications, for their testing and for their use in a working environment

Learning skills
The student should be able to acquire new programming languages and tools for the development of modular and reusable software components as well as to identify and use already available software components.

Prerequisiti

Besides prerequisites required for access to the Laurea programme, knowledge about the notions concerning vectors and matrices acquired in the course of Mathematics is requested. Also the ability to interact with a computer system as a user is a prerequisite.

Contenuti del corso
Elements of computer architectures. Data representation. Computer arithmetic. Boolean algebra. Structure and components of a computer system. Distributed systems (15 hours)
Operating systems. Structure of operating systems. Elements of process management, memory management, peripherals management. File system and user interface. (15 hours)
Compiled languages vs Interpreted languages. The Python language. Structure of a Python program. Built-in basic types and arithmetic/logical operators, statements, input/output, basic control structures/statements. Complex datatypes (sequences) and built-in methods. File formats (csv, json, xml). Data manipulation and visualization. Standard libraries and reusable software components. Advanced programs and data structures. Functions and passing parameters. Functional programming. Lambda expressions. The map and filter functions (40 hours)
Object-Oriented Programming. The concept of class, subclass and interface. Methods and attributes. Modularity and information hiding. Inheritance and polymorphism. Introduction to Design Patterns. (15 hours)
Fundamentals of Software development and organization. Modelling tools for software systems: UML (Class diagrams, Use case diagram, Sequence diagram). Code version control tools. Test Driven Development (15 hours).

Metodi didattici
Lectures and flipped classrooms presenting the topics of the course and carried out exercises to show their application to specific problems (70 hours, about 30% of which is devoted to present examples and develop exercises). Laboratory sessions to teach the use of software tools needed for Python programming and to develop exercises (30 hours).

Modalità di verifica dell'apprendimento
Knowledge assessment methods and criteria:
Knowledge and abilities acquired during the course will be evaluated by a practical programming assessment concerning Python coding abilities and by an oral test in which is requested the illustration of theoretical topics covered by the course programme. The student must also demonstrate that he/she is familiar with and has been able to adequately apply the methodologies and techniques presented in the course.

Criteria for measuring learning and defining the final grade:
The final score is expressed as a fraction of 30 and the examination is passed if both tests have received a minimum score of 18. The practical assessment and theoretical topics discussion contribute for 3/5 and 2/5, respectively, to the final score

Testi di riferimento
Lecture notes, Powerpoint presentations, exercises, freely distributed in electronic format at http://elearning.unicampus.it/.

The contents of the course can be found in English in the following textbooks:
• J. Hunt, "A Beginners Guide to Python 3 Programming", Springer
• Luciano Ramalho, Fluent Python, O'Reilly
• Online documentation of Python packages

Altre informazioni
Knowledge and understanding.
The course will transfer the following knowledge and understanding to the student:
• Knowledge and understanding of basic elements of computer architectures, including distributed systems
• Knowledge of user interfaces for interaction with a computing system
• Knowledge of data representation and storage in computer systems
• Knowledge and understanding of basic principles of Object-Oriented Programming
• Knowledge of one or more programming languages that support modular development and reuse of software in a distributed environment
• Knowledge and understanding of basic algorithms on sequences and multidimensional data structures
• Knowledge of methodologies for software quality assurance and documentation
• Knowledge of tools supporting software development and maintenance

Applying knowledge and understanding.
At the end of the course the student will be able to:
• Manage data and software applications in a standard computing environment
• Understand how to employ reusable software components from available documentation
• Use a programming language to develop modular and reusable software components
• Perform quality control of software components and prepare the documentation required for their reuse
• Manage the development cycle of software components

Making judgments

The knowledge and understanding skills acquired must give the student the ability to evaluate and select, on the basis of the requirements specifications, the most appropriate tools and software components for the development and reuse of modular software. The student will also have the ability to:
• Evaluate the correctness of the proposed algorithm
• Evaluate the appropriateness of the proposed algorithm for solving a given problem

Communication skills
The student will develop the ability to:
• Explain to users how utilize software application they have developed
• Communicate, in a timely and competent manner, the choices made in the development of software applications
• Prepare the documentation aimed at reuse and maintenance of the modular solutions
• Interact with computer science experts for requirements specification of advanced data processing applications, for their testing and for their use in a working environment

Learning skills
The student should be able to acquire new programming languages and tools for the development of modular and reusable software components as well as to identify and use already available software components.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Ingegneria

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Corso di Laurea	Biomedical Engineering (2022)	comune	10	ING-INF/05

Stampa del 13/07/2023

General English [2303106]

Offerta didattica a.a. 2022/2023

Docenti:

Periodo: Primo Ciclo Semestrale

Obiettivi formativi

Il Corso è articolato sui primi due anni del Corso di Laurea in Biomedical Engineering. Il primo anno di corso è finalizzato al potenziamento della conoscenza della lingua straniera ad un livello C1, propedeutico all'insegnamento dell'inglese tecnico professionale previsto al secondo.

Prerequisiti

Ogni studente è tenuto a possedere un livello minimo d'accesso al corso di laurea B2. Gli studenti con un livello iniziale superiore al livello C1 CEFR potranno essere esonerati previa domanda di esonero.

Contenuti del corso

Il corso curricolare da 3 CFU si articola in due parti, ciascuna della durata di un semestre. Durante il primo anno di corso, si approfondiscono le strutture logico-grammaticali e il vocabolario della lingua inglese al fine di consentire il raggiungimento del livello C1. Al secondo anno, il corso si concentra sull'utilizzo della terminologia tecnica, sulla comprensione di documenti scientifici, nonché sulla capacità di esporre professionalmente argomenti di carattere ingegneristico.

Metodi didattici

Il corso viene erogato attraverso lezioni frontali ed esercitazioni organizzate attraverso la didattica a gruppi. Il corso del secondo anno è erogato attraverso lezioni frontali in cui gli studenti vengono stimolati ad interagire tra di loro e con il docente simulando situazioni di ambito professionale.

Modalità di verifica dell'apprendimento

Metodi e criteri di valutazione dell'apprendimento
Esame scritto e orale
Nel primo anno la verifica viene effettuata attraverso una prova di idoneità composta da una prova scritta e l'ascolto di un brano. Il secondo anno, lo studente dovrà sostenere un esame scritto e orale scritta su un argomento affrontato durante il corso, con voto finale espresso in trentesimi. Nell'attribuzione del voto si tiene conto della correttezza grammaticale, della pronuncia e dell'appropriatezza del lessico specifico della professione.

Criteri di misurazione dell'apprendimento e di attribuzione del voto finale
Nel primo anno di corso le conoscenze lessicali e grammaticali e le abilità relative alla comprensione orale e alla produzione scritta sono verificate al termine del primo semestre mediante: una prova scritta che si articola su stesura di un elaborato e prova di ascolto con rispettivo test di comprensione a risposta aperta.
Nel secondo anno la valutazione finale è espressa in trentesimi e sarà attribuita valutando la correttezza grammaticale, la pronuncia e i contenuti tecnico-professionali studiati.

Testi di riferimento

Il materiale didattico consigliato al primo anno:
Libro di testo: Life
Editore: ☐ National Geographic Learning; 2° edizione
Moduli e unità del libro verranno indicati dal docente durante la prima lezione del corso.

Il materiale didattico del secondo anno verrà fornito dai docenti all'inizio del corso.

Altre informazioni

Il primo anno di corso è finalizzato al raggiungimento del livello C1. Ciascuno studente dovrà dimostrare di essere in grado di ampliare il suo vocabolario e utilizzare adeguatamente le strutture logico-grammaticali commisurate all'obiettivo linguistico del corso. A conclusione del secondo anno, lo studente dovrà dimostrare un'adeguata padronanza del linguaggio tecnico professionale.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Ingegneria

Tipo corso	**Corso di studio (Ordinamento)**	**Percorso**	**Crediti**	**S.S.D.**
Corso di Laurea	Biomedical Engineering (2022)	comune	1	L-LIN/12

Stampa del 13/07/2023

General Physics [2303104]

Offerta didattica a.a. 2022/2023

Docenti: ALESSANDRO LOPPINI

Periodo: Ciclo Annuale Unico

Obiettivi formativi
Specific Learning objectives:
The course aims to provide the fundamentals of classical mechanics, thermodynamics and electromagnetism and give a basic knowledge of physical laws. The primary learning objective is the development in the student of the ability to grasp the essential aspects of physical processes, framing them coherent descriptive and quantitative mathematical models concerning biomedical engineering applications.

Specific learning outcomes:
Knowledge and understanding.
Students will achieve an adequate knowledge of physical laws and related mathematical aspects on broad aspects of classical physics, including:
- kinematics and newtonian dynamics
- fluids
- calorimetry and thermodynamics
- electromagnetism and geometrical optics

Students will learn methodological-operational aspects of physics integrated with the other basic sciences, to interpret and describe engineering problems.

Applying knowledge and understanding.
At the end of the course, students will be able to correctly use theoretical knowledge to solve for practical problems and applications. Students will be able to interpret physical laws and apply them in different fields typical of engineering applications. The ability to apply knowledge and understanding to specific problems will be achieved through classroom practical sessions.

Making judgments
At the end of the course, students will be able to combine the acquired theoretical knowledge and practical experience to assess and analyze physical phenomena, by making assumptions and decisions in a consistent and reasoned way.

Communication skills
Students will develop the ability to describe physical laws at different levels of detail. In particular, they will be able to use both a proper technical vocabulary and calculus skills to explain physical processes and the models behind them.

Learning skills
The class will provide individual skills in learning new topics by working on the basic knowledge acquired during the lectures. Students will acquire the capacity to learn advanced details on the topics presented and to extend their knowledge on further aspects of modern physics and in engineering applications.

Prerequisiti
Precalculus. A basic prior knowledge of calculus is recommended.

Contenuti del corso
Contents - modulus 1 (FIS/07):
- Introduction. The scientific method. Physical quantities, measurement units systems. (2 hours)
- Kinematics in one and two dimensions. Displacement, velocity, acceleration. Motion at constant acceleration. Falling body. Circular motion. Projectile motion. (4 hours)
- Single particle dynamics: Newton's laws. Inertia principle. Mass and force. The second and third laws of motion. Inertial and non-inertial reference systems. Weight force. Constraints and contact forces. Strings and springs. Friction. Drag forces. (6 hours)
- Work and kinetic energy. Conservative forces and potential. Conservation of mechanical energy. Impulse and linear momentum. Systems of particles. Center of mass. (6 hours)

- Conservation of linear momentum. Kinetic energy of a system. Collisions. (4 hours)
- Rotations and rigid bodies dynamics. Torque. Moment of Inertia. Rotational kinetic energy. Rigid body rotation with fixed axis. Rolling motion. Static equilibrium. Elastic properties of solids. (6 hours)
- Angular momentum and conservation of angular momentum. Newton’s law of gravity and gravitational field. Kepler’s laws. (2 hours)
- Oscillations. Harmonic motion. Damped oscillations. Driven oscillations and resonance. (4 hours)
- Fluids. Density and pressure. Stevin's law. Buoyant force and Archimedes' principle. Fluids in motion: inviscid fluids and Bernoulli equation. Torricelli's law. Viscid fluids and Poiseuille's law. (4 hours)
- Thermodynamics and thermodynamic systems. Equilibrium states. Temperature and Kinetic theory of gases. Thermal equilibrium and thermometers. Zero law of thermodynamics. Ideal gases. Heat and specific heats. Latent heat. Thermodynamic processes. Work. Joule's experiment and first law of thermodynamics. Internal energy. Transfer of heat. Heat engines and the second law of thermodynamics. Thermodynamic cycles. Carnot engine. Irreversibility and Entropy. (8 hours)

Practical sessions on selected problems will be delivered for a total of 24 hours.

Contents - modulus 2 (FIS/03):

- Electrostatics in vacuum. Electrical field and electrical potential, the Gauss Theorem. (4 hours)
- Electrostatics in conductors and insulators. Electrostatic energy. (4 hours)
-the Electrics structure of matter: dielectrics. Polarisation. The first two Maxwell equation (2 hours)
-Stationary and quasi-stationary electric current. Circuits' laws. Joule's effect. Electric generators. (4 hours)
-Magnetostatics in vacuum and in matter. Magnetic field and Ampere’s law. (4 hours)
-Time varying electric and magnetic fields. Faraday’s law of induction. Self and mutual inductance. (2 hours)
-Basic electric circuits (2 hours)
-Alternating current (2 hours)
-Maxwell's equations. Electromagnetic waves and energy transport. (4 hours)
-Reflection and refraction. Interference and diffraction. (2 hours)
-Geometrical optics: dioptre, lenses, mirrors, optical systems. (4 hours)

Practical sessions on selected problems will be delivered for a total of 16 hours.

Metodi didattici

Theoretical and practical lectures focused on the topics of the course. Teaching methods involve frontal lectures, slides and whiteboard.

Modalità di verifica dell'apprendimento

Knowledge assessment methods and criteria:
The Knowledge will be assessed through 2 written tests, including practical problems and theoretical questions. The first test will be delivered at the end of the first semester, and it will be focused on the first module, including Mechanics and Thermodynamics. The second test will be delivered at the end of the second semester, and it will test students’ knowledge of the second modulus of the class, including Electromagnetism and Optics. Students will have to demonstrate their knowledge by specifying every mathematical step involved in solving problems, and the adopted assumptions and calculus must consistently support the final answers.

Criteria for measuring learning and defining the final grade:
The final grade will consider the scores of both the first and second semester tests. To pass, a student has to reach the minimum score of 18 (60% of correct answers supported by correct reasoning on the problem) in each test. If the student fails one of them, he/she will have the opportunity to take only the test related to those topics at the end of the class. If the student fails both the tests, he/she will have to take a unique test focused on all the topics at the end of the class. The final score will be an arithmetic average of the scores achieved in the abovementioned tests.

Testi di riferimento

- Slides and material produced by lecturers and uploaded on the e-learning platform.
- Suggested textbooks: Physics for Scientists and Engineers, Extended Version. 6th Edition, 2020. Paul A. Tipler, Gene Mosca. Macmillan.

Altre informazioni

Knowledge and understanding
Students will achieve an adequate knowledge of physical laws and related mathematical aspects on broad aspects of classical physics, including:
- Kinematics and Newtonian dynamics.
- Fluids.
- Calorimetry and thermodynamics.
- Electromagnetism and geometrical optics.

Students will learn methodological-operational aspects of physics to interpret and describe medical and engineering problems.

Applying knowledge and understanding
At the end of the course, students will be able to correctly use theoretical knowledge to solve for practical problems and applications. Students will be able to interpret physical laws and apply them in different fields typical of medical and bioengineering applications. The ability to apply knowledge and understanding to specific problems will be achieved through classroom practical sessions.

Making judgments
At the end of the course, students will be able to combine the acquired theoretical knowledge and practical experience to assess and analyze physical phenomena, by making assumptions and decisions in a consistent and reasoned way.

Communication skills
Students will develop the ability to describe physical laws at different levels of detail. In particular, they will be able to use both a proper technical vocabulary and calculus skills to explain physical processes and the models behind them.

Learning skills
The class will provide individual skills in learning new topics by working on the basic knowledge acquired during the lectures. Students will acquire the capacity to learn advanced details on the topics presented and to extend their knowledge on further aspects of modern physics and on biomedical and bioengineering applications.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Ingegneria

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Corso di Laurea	Biomedical Engineering (2022)	comune	12	FIS/07, FIS/03

Stampa del 13/07/2023

Italian [2303107]

Offerta didattica a.a. 2022/2023

Docenti:

Periodo: Primo Ciclo Semestrale

Syllabus non pubblicato dal Docente.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Ingegneria

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Corso di Laurea	Biomedical Engineering (2022)	comune	1	L-FIL-LET/12

Stampa del 13/07/2023

Mathematics [2303102]

Offerta didattica a.a. 2022/2023

Docenti: MARTA MENCI

Periodo: Primo Ciclo Semestrale

Obiettivi formativi

Il corso fornisce agli studenti gli strumenti matematici di base necessari nelle scienze ingegneristiche, ed è strutturato con l'obiettivo di aumentare la loro conoscenza e capacità di apprendimento nell'ambito dell'analisi matematica e dell'algebra lineare. Gli studenti apprendono come strutturare e risolvere problemi di natura matematica, supportati da numerosi esempi. Entro la fine del corso, gli studenti saranno in grado di affrontare con successo la risoluzione di esercizi matematici non banali, oltre ad avere una chiara comprensione dei risultati teorici più importanti discussi nel corso.
Il corso desidera presentare la matematica come un corpo organizzato di conoscenze che fornirà agli studenti una solida base per le successive applicazioni in ambito ingegneristico.

Prerequisiti

Fondamenti di algebra: equazioni e disequazioni di primo e secondo ordine, equazioni e disequazioni razionali, sistemi di equazioni e disequazioni di primo e secondo ordine, equazioni e disequazioni esponenziali e logaritmiche, trigonometria, divisione di polinomi, equazioni e disequazioni irrazionali, teoria degli insiemi, tecniche di induzione.
Geometria: retta, circonferenza, parabola, ellisse, iperbole.

Contenuti del corso

Algebra Lineare (Dr. Marta Menci)
Sistemi di equazioni lineari: introduzione ai Sistemi di Equazioni lineari. Eliminazione di Gauss e Eliminazione di Gauss-Jordan. Applicazioni dei sistemi di Equazioni lineari. Matrici. Operazioni con le Matrici. Proprietà delle operazioni matriciali. Inversa di una Matrice. Matrici elementari. Catene di Markov. Ulteriori applicazioni delle operazioni matriciali. Determinanti: Determinante di una matrice. Determinanti ed operazioni elementari. Proprietà dei determinanti. Applicazioni dei determinanti.
Spazi vettoriali. Vettori nello spazio Euclideo. Sottospazi vettoriali. Insiemi di generatori e Lineare Indipendenza. Basi e dimensione di spazi vettoriali. Rango di una matrice e sistemi di equazioni lineari. Coordinate e cambio di base. Autovalori e Autovettori. Diagonalizzazione di una matrice. Matrici simmetriche. Matrici definite positive. Matrici simili.
Calcolo e Analisi Reale (Prof. Marco Papi)
Modelli Matematici: funzioni fondamentali. Costruzione di funzioni. Funzioni esponenziali. Funzioni Trigonometriche. Funzioni inverse e logaritmi.
Numeri e funzioni. Proprietà dei numeri Reali e Disuguaglianze. Fondamenti dei Numeri Complessi. Successioni. Convergenza di Successioni. Sottosuccessioni e successioni di Cauchy. Funzioni e limiti. Definizione di Limite. Limiti di funzione. Calcolo di limiti tramite leggi. Limite ad infinito: asintoti orizzontali. Continuità di funzioni. Proprietà fondamentali delle funzioni continue. Derivate: derivate e significato geometrico. La funzione derivata. Regole di derivazione: derivate di polinomi e funzioni esponenziali. Regole del prodotto e del quoziente. Monotonia, convessità e concavità. Minimi e massimi assoluti. Estremi locali e punti di flesso. Approssimazioni lineari e quadratiche. Metodi di Picard e Newton. Integrazione. Integrale di Riemann. Somme di Riemann. Funzioni integrabili. Teorema fondamentale del calcolo. Integrali indefiniti. La regola di sostituzione. Integrazione per parti. Equazioni differenziali ordinarie lineari di primo e secondo ordine. Separazione delle variabili.

Metodi didattici

- Lezioni (80 ore): argomenti del programma del Corso e svolgimenti di esercizi, al fine di mostrare le applicazioni a contesti specifici.
- Esercitazioni frontali (20 ore), in aula, con programmazione settimanale.

Modalità di verifica dell'apprendimento

Conoscenze e capacità saranno verificate tramite una prova scritta, che include 4 esercizi di cui si richiede lo svolgimento, e 4 domande a scelta multipla, relativi ai seguenti argomenti:
spazi vettoriali, matrici, sistemi di equazioni lineari, funzioni di una variabile reale, integrazione di funzioni reali, equazioni differenziali ordinarie lineari.

La scelta della modalità in forma aperta per gli esercizi permette di stabilire l'effettivo livello di apprendimento e di abilità di elaborazione autonoma degli studenti, come descritto negli obiettivi del corso. In particolare, il compito scritto ha lo scopo di riconoscere la capacità di identificare gli aspetti più significativi degli argomenti e di esporli in maniera corretta ma anche sintetica. Nei quesiti a scelta multipla, gli studenti saranno chiamati a rispondere a domande principalmente relative a contenuti teorici del programma del corso. Il punteggio totale della prova scritta è 32 (massimo), e il tempo assegnato per il completamento della prova è di 2 ore e 30 minuti. L'esame comporta una valutazione espressa in trentesimi. L'esame viene ritenuto superato se il punteggio del compito scritto è uguale o superiore a 18/32. Se il punteggio è superiore a 30/32, il voto finale dell'esame è 30 e Lode.

Testi di riferimento

[1] D.C. Lay, "Linear Algebra and Its Applications", Addison-Wesley, Fourth Edition. [2] J. Stewart, "Calculus, Early Transcendentals", Brooks/Cole, Seventh Edition. [3] Walter Rudin, Principles of Mathematical Analysis, third edition, McGraw-Hill.

Altre informazioni

Conoscenza e capacità di comprensione
Il corso fornirà agli studenti conoscenze e capacità di comprensione nei seguenti ambiti:
- Algebra Lineare: vettori, matrici, sistemi di equazioni lineari, autovalori ed autovettori;
- Calcolo Differenziale e Integrale: studio delle principali proprietà analitiche di funzioni a valori reali;
- Equazioni Differenziali Ordinarie lineari.

Gli studenti saranno in grado di comprendere i concetti fondamentali dell'Algebra Lineare, quali operazioni tra vettori, matrici e metodi di risoluzione di sistemi di equazioni lineari. Inoltre, gli studenti acquisiranno conoscenze in ambito di calcolo differenziale e integrale, comprendendo le proprietà caratteristiche di funzioni a valori reali.

Conoscenza e capacità di comprensione applicate
Entro la fine del corso, gli studenti saranno in grado di:
- descrivere la natura di Spazi Vettoriali;
- discutere i risultati di Sistemi di equazioni lineari e di Equazioni differenziali ordinarie lineari;
- studiare e rappresentare funzioni a valori reali.

Gli studenti applicheranno le conoscenze acquisite per risolvere problemi di utilità pratica (ad esempio, problemi che includono operazioni con matrici, vettori, limiti, integrali ed equazioni differenziali lineari).

L'attività didattica è offerta in:

Facoltà Dipartimentale di Ingegneria

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Corso di Laurea	Biomedical Engineering (2022)	comune	10	MAT/08

Stampa del 13/07/2023

OFA-Matematica [2303OFA01]

Offerta didattica a.a. 2022/2023

Docenti: FLAVIA SMARRAZZO

Periodo: Primo Ciclo Semestrale

Contenuti del corso

Analytical geometry: Lines, Circles, Parabolas, Ellipses, Hyperboles.
Rational Equations and Inequalities: Second and higher order degree.
Irrational Equations and Inequalities.
Exponentials and Logarithmic functions: properties, equations and inequalities.
Trigonometric functions: trigonometric equalities and inequalities.

Volumes and Areas of Shapes.
Domains of functions.
Basic concepts of probability, unconditional and conditional probability.
Proportions and percentages.

Modalità di verifica dell'apprendimento

Written (Multiple choice test)

Testi di riferimento

Book:J. Stewart, "Calculus, Early Transcendentals", Brooks/Cole, Seventh Edition.

Supplementary materials is provided by the Professor. Notes and slides on the topics of the program are uploaded in a dedicated section of the e-learning page of the course (Mathematics).

L'attività didattica è offerta in:

Facoltà Dipartimentale di Ingegneria

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Corso di Laurea	Biomedical Engineering (2022)	comune	0	MAT/08

Stampa del 13/07/2023

Physiology and Anatomy [2303108]

Offerta didattica a.a. 2022/2023

Docenti: GIOVANNI DI PINO, GIORGIO VIVACQUA

Periodo: Ciclo Annuale Unico

Obiettivi formativi
Lo studente deve acquisire conoscenza e comprensione dell'organizzazione generale del corpo umano e degli specifici modelli e regole che ne determinano il funzionamento, con comprensione della morfologia e degli aspetti quantitativi della funzione di cellule, tessuti e organi, sia a livello macroscopico che microscopico.

Prerequisiti
Conoscenze generali di Chimica, Fisica e Biologia Molecolare

Contenuti del corso
Fisiologia: Controlli a feedforward e feedback ed omeostasi; Canali ionici; Potenziale di membrana e potenziale d'azione; Conduzione di segnali elettrici nelle fibre nervose; Sinapsi, integrazione sinaptica e plasticità; Fisiologia muscolare; Modello di Hill del muscolo; Sistema nervoso autonomo; Fisiologia cardiaca (ciclo cardiaco, regolazione gittata cardiaca, metabolismo cardiaco, circolazione coronarica); Volemia e principi di Emodinamica, Sistema respiratorio; Trasporto dei gas nel sangue; Fisiologia renale; Ormoni renali ed equilibrio Acido-Base; Sistema digerente e fegato; Fisiologia sistema endocrino e pancreas; Fisiologia visiva; Fisiologia uditiva e sistema vestibolare; Sistema somatosensoriale (tocco, propriocezione e dolore); Fisiologia del sistema motorio.

Anatomia: Organizzazione generale della cellula. Citologia e biologia cellulare di base: struttura delle membrane cellulari, citoplasma e organelli citoplasmatici, principi di visualizzazione e funzione del DNA e dell'RNA. Differenziazione e specializzazione cellulare. Cellule staminali. I diversi tessuti del corpo: tessuto epiteliale, tessuti connettivi, tessuto muscolare e nervoso. Basi morfologiche delle reti neuronali. Elementi di ingegneria tissutale. Panoramica generale del corpo e degli apparati con elementi di anatomia comparata dei vertebrati. Apparato locomotore: cenni generali, struttura delle ossa e basi anatomiche della statica e della cinematica. Struttura delle articolazioni e focus sulle basi anatomiche delle applicazioni protesiche. Organizzazione del Sistema Nervoso Centrale e dei nervi periferici. Corteccia cerebrale e basi morfologiche dell'elettroencefalografia. Basi anatomiche della percezione, controlli del movimento e funzione della memoria. Organizzazione degli organi di senso. Sistema cardiovascolare: organizzazione generale. Struttura delle arterie e delle vene, struttura dettagliata delle valvole cardiache e aspetti applicativi dell'ingegneria tissutale. Apparato Respiratorio: organizzazione generale. L'alveolo polmonare e le basi anatomiche dello scambio gassoso con i principi della ventilazione assistita. Il sistema urinario: organizzazione generale, glomerulo e nefrone. Basi anatomiche della terapia dialitica.

Metodi didattici
Lezioni interattive anche con il supporto di tutor per l'apprendimento in piccoli gruppi e metodo della "flipped classroom" (insegnamento capovolto).
Lezioni pratiche interattive ed esercizi.
Saranno offerti seminari su argomenti selezionati e gli studenti saranno incoraggiati verso la ricerca nella letteratura scientifica.

Modalità di verifica dell'apprendimento
L'esame dei contenuti sarà un esame integrato dei due moduli.
Per quanto riguarda la parte di Anatomia, si compone di una prova scritta, volta a valutare l'acquisizione e la capacità di applicare le conoscenze, nella quale gli studenti devono dimostrare di aver raggiunto un livello adeguato di conoscenza dell'argomento, con particolare riferimento all'anatomia funzionale, e gli aspetti applicativi dell'anatomia nell'ingegneria biomedica. La prova scritta sarà composta da 10 domande a risposta multipla con un riquadro in cui motivare la risposta. Al termine del corso integrato è prevista una prova orale incentrata sugli aspetti integrati dei due moduli.
Per quanto riguarda la parte di Fisiologia, la valutazione avviene tramite prova orale. Le conoscenze e le capacità di comprensione acquisite vengono valutate con domande sulla fisiologia dei principali organi e sulla neurofisiologia. La capacità di applicare le conoscenze e la comprensione, rielaborandole in modo ragionato, viene valutata con problemi aperti di fisiologia applicata. Particolare enfasi è posta sulle capacità comunicative degli studenti e sulla loro capacità di riformulare criticamente i concetti appresi. Gli studenti sono inoltre tenuti a rappresentare graficamente modelli e relazioni tra parametri fisiologici.

Il voto finale dell'esame è espresso in trentesimi. L'esame si svolge al termine del corso nelle date previste dal calendario accademico.
Per la votazione finale sono presi in considerazione anche i risultati di eventuali progetti pratici ed esercitazioni svolti durante il corso. I criteri di valutazione per il colloquio orale sono: la correttezza, completezza e chiarezza dell'esposizione; la capacità di riconoscere e descrivere immagini di strutture anatomiche e di risolvere questioni relative alle loro funzioni; la capacità di applicare le conoscenze integrando gli argomenti trattati nei due moduli.
Il punteggio finale è basato su una media delle valutazioni dei singoli argomenti, ponderata sul tempo del corso dedicato a ciascun argomento specifico.

Testi di riferimento
Dopo le lezioni riguardanti una parte del programma, agli studenti verrà fornito il relativo materiale didattico.

I principali libri di testo consigliati sono:

Anatomia
Gray's Anatomy for Students: With Student Consult Online Access Paperback – Illustrated, 11 Aprile 2019

Fisiologia
John Hall, Guyton and Hall Textbook of Medical Physiology, quattordicesima edizione, 2020
Kandel/Koester/Mack/Siegelbaum, Principles of neural science, sesta edizione, 2021.
Joseph Feher, Quantitative Human Physiology: An Introduction, seconda edizione, 2016
Conti’s Physiology Textbook, English edition (in preparazione, dovrebbe essere disponibile nel 2023)

Altre informazioni
Alla fine del corso, lo studente deve essere in grado di:
• Descrivere l'organizzazione generale del corpo umano considerata a livello macroscopico e microscopico, mettendo in relazione l'organizzazione strutturale con le corrispondenti funzioni di apparati, organi e tessuti.
• Conoscere gli indicatori chiave e i parametri fisiologici delle funzioni corporee e il loro range di normalità.
• Conoscere le teorie fondamentali dietro le funzioni fisiologiche e le loro più importanti basi sperimentali.
• Modellare quantitativamente l'interazione tra i parametri fisiologici studiati e la funzione degli organi principali con un livello di formalismo matematico e fisico adeguato allo svolgimento della professione di ingegnere biomedico.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Ingegneria

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Corso di Laurea	Biomedical Engineering (2022)	comune	10	BIO/09, BIO/16

Stampa del 13/07/2023

The History of Biomedical Engineering in Twelve Machines [2303109]

Offerta didattica a.a. 2022/2023

Docenti: LUCA BORGHI

Periodo: Primo Ciclo Semestrale

Obiettivi formativi

Specific Learning objectives:
The course aims to retrace the history of the relationship between medicine and technology during the last two centuries through the role played by twelve medical instruments that literally changed the face of healthcare. In addition to the technical history of these inventions, attention will also be focused on the human factor of the protagonists of these stories and on the wider medical and scientific framework that made them possible.

Specific learning outcomes:
• Knowledge and understanding of the importance of the “human factor” in the history of technical-scientific instruments and their evolution over time.
• Autonomy of judgment of the psychological, socio-cultural and ethical aspects of the instrumental evolution.
• Communication skills to be exercised and demonstrated in the personal synthesis during the oral exam about the topics discussed in class.
• Apply knowledge to the discovery and analysis of cases of "cross-fertilization" between different disciplinary areas (engineering and medicine).
• Ability to learn in the further independent analysis of other instrumental evolutions and in the comparison of these with similar current situations.

Prerequisiti

Prerequisites required for access to the Laurea programme.

Contenuti del corso

1. Introduction. Specula and forceps: to the roots of medicine.
2. The stethoscope and the instrumental diagnostic revolution.
3. The inhaler. When surgery knocked out pain.
4. The ophthalmoscope and the rise of modern ophthalmology.
5. The sphygmograph. Étienne-Jules Marey, the physician who wanted to be an engineer.
6. The X-rays apparatus. Wilhelm Röntgen and the radiological revolution.
7. The negative pressure chamber and the controversial figure of Ernst Ferdinand Sauerbruch.
8. The electrocardiograph. How to cope with a crazy heart.
9. The iron lung and the long battle against polio.
10. The electron microscope and the discovery of the invisible.
11. The heart-lung machine and the taboo of open-heart surgery.
12. The electroconvulsive therapy machine. Just a skeleton in the closet of modern psychiatry?

One class of an hour will be dedicated to each of these subjects.

Metodi didattici

Lectures.

Modalità di verifica dell'apprendimento

Knowledge assessment methods and criteria:
The assessment will be through an oral interview that will explore both the knowledge of the main course's topics and the ability of the student to highlight and explain the aspects related to the "human factor" and the ability of “cross-fertilization” of their protagonists.

Criteria for measuring learning and defining the final grade:
The final score is expressed as a fraction of 30 and the examination is passed if the oral test has received a minimum score of 18. Praise is attributed to the candidate demonstrating a high level of mastery of the subjects covered by the oral test.
The final judgement will average with those obtained in the other parts of the Integrated Course of Humanities for Engineering.

Testi di riferimento
Powerpoint presentations of each lecture, shared through the ELEA platform.

The contents of the course can be found in the following textbooks (specific chapters will be provided to students):
• Luca Borghi, Sense of Humors. The Human Factor in the History of Medicine, KDP Publishing 2022
• Andras Gedeon, Science and technology in medicine: an illustrated account based on ninety-nine landmark publications from five centuries, Springer 2006
• Stanley Joel Reiser, Medicine and the Reign of Technology, Cambridge University Press 1981
Further material will be provided during the course.

Altre informazioni
• Knowledge and understanding of the importance of the “human factor” in the history of technical-scientific instruments and their evolution over time.
• Autonomy of judgment of the psychological, socio-cultural and ethical aspects of the instrumental evolution.
• Communication skills to be exercised and demonstrated in the personal synthesis during the oral exam about the topics discussed in class.
• Apply knowledge to the discovery and analysis of cases of "cross-fertilization" between different disciplinary areas (engineering and medicine).
• Ability to learn in the further independent analysis of other instrumental evolutions and in the comparison of these with similar current situations.

L'attività didattica è offerta in:

Facoltà Dipartimentale di Ingegneria

Tipo corso	Corso di studio (Ordinamento)	Percorso	Crediti	S.S.D.
Corso di Laurea	Biomedical Engineering (2022)	comune	1	MED/02

Stampa del 13/07/2023