



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze e Tecnologie Biologiche, Chimiche e Farmaceutiche
ACADEMIC YEAR	2023/2024
MASTER'S DEGREE (MSC)	PHARMACY
SUBJECT	PHYSICS WITH ELEMENTS OF MATHEMATICS
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	74741-Discipline Matematiche, Fisiche, Informatiche e Statistiche
CODE	19181
SCIENTIFIC SECTOR(S)	FIS/07
HEAD PROFESSOR(S)	D'OCA MARIA CRISTINA Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	10
INDIVIDUAL STUDY (Hrs)	164
COURSE ACTIVITY (Hrs)	86
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	D'OCA MARIA CRISTINA Monday 11:00 12:00 nel proprio studio (stanza A02) presso l'edificio 18 di viale delle scienze.

DOCENTE: Prof.ssa MARIA CRISTINA D'OCA

PREREQUISITES	Basic knowledge of math and physics (minimum knowledge)
LEARNING OUTCOMES	Learning Capacity: Ability to continue studies using the basic training received during the course. Upgrade ability with consultation of scientific publications. Knowledge and understanding: Acquiring the mathematical tools needed to continue the studies of the Pharmacy Degree Course. Ability to interpret and describe natural phenomena based on physical laws. Ability to use scientific language. Ability to apply knowledge and understanding: Ability to apply the instruments of infinitesimal calculation and whole wheat. Know how to use the physical laws for designing and understanding scientific experiments, including through the use of templates. Judgment autonomy: Being able to comment critically and autonomously on natural phenomena with mathematical and physical tools. Knowing the cause-effect relationships, knowing to evaluate logically and objectively the results of Scientific experiments. Communication skills: Ability to expose the results of experiments by functions and graphs. Being capable of describing scientific observations in a simple but at the same time rigorous manner. Learning Capacity: Ability to continue studies using the basic training received during the course. Upgrade ability with consultation of scientific publications.
ASSESSMENT METHODS	Profit is verified by Written Test and Oral Test. The expected written test can be done in two ways. The first mode provides for the subdivision into n.2 Test Scripts: The first written test consists of an optional on-the-job test for the student during the term (during the calendar appeals) and provides: • a duration of at least 1 hour • A minimum of 10 multiple-choice questions, consisting of a series of questions, each with four closed answers. The questions of the questions are both theory and practice, in order to evaluate the learning and knowledge of the topics that have taken place in the first weeks of the course. Each question is assigned a score of 1 to 3 (depending on the complexity of the question) if the answer is correct, no score if the answer is incorrect or omitted. The test is exceeded if a vote of at least 18/30 is reached. The second written test consists of completing the completed written test (during the appended calculations) only for the students who have passed the test in the course of time and provides: • lasts at least 1 hour • a minimum of 10 multiple-choice questions consisting of a series of questions, each with four closed answers. The questions of the questions are both theory and practice, in order to evaluate the learning and knowledge of the arguments that have taken place during the resident part of the course (excluding the arguments already required during the oninere test). Each question is assigned a score of 1 to 3 (depending on the complexity of the question) if the answer is correct, no score if the answer is incorrect or omitted. The test is exceeded if you get a vote of at least 18/30 The arithmetic mean of the two acquired votes constitutes the final vote of the whole matter. For those students who did not pass or attended the written test in the course of the course, there is a second method of completion that consists of one written test (during the calendar appeals) and provides: • a duration of 2 hours • a minimum of 20 multiple-choice questions consisting of a series of questions, each with four closed answers. The topics of the questions are both theory and practice in order to Evaluate the learning and knowledge of the topics that have taken place throughout the course. The test is exceeded if a vote of at least 18/30 is reached. For students who have passed the written test, an oral exam is foreseen: • In a conversation with a minimum of three open questions to verify the acquired knowledge, abilities, and possessing an adequate display capacity. The test is exceeded if a vote of at least 18/30 is reached and the arithmetic mean of the marks of the written test and the oral test is the final vote of the matter.
EDUCATIONAL OBJECTIVES	Provide the student with the knowledge and tools of Mathematics useful for continuing the studies of the PhD degree in Pharmacy: solving equations, inequalities and simple problems of analytical geometry; Understand the meaning and purpose of the infinitesimal and integral calculus tools, and use these tools: perform a complete study of a function and analyze Critically the graph of a function; Solve simple differential equations of the first and second order, used for example in the models that describe the metabolism of drugs. Also provide the student with the knowledge of physics of solids, fluids, thermodynamics and electromagnetism with particular attention to topics involving applications of chemistry, physiology and pharmaceutical technology.
TEACHING METHODS	Lectures, Classroom Exercises The course consists of lecture lessons and exercises.

SUGGESTED BIBLIOGRAPHY	TESTI DI MATEMATICA Carlo Sbordone-Francesco Sbordone: Matematica per le scienze della vita. Edises ISBN 9788879598293 ESERCIZI: G.Zwirner: Esercizi di analisi matematica. Ed. CEDAM, Padova ISBN 8813341881 P.Marcellini, C.Sbordone: Esercitazioni di matematica; primo volume, parte prima e seconda. Liguori Editore. ISBN 9788820752521 A. Bartolotta, S.Calabrese, Esercizi di Matematica svolti (per i corsi di laurea delle facoltà scientifiche). Edises. ISBN 9788879595469 TESTI DI FISICA F.Borsa, A. Lascialfari: Principi di Fisica per indirizzo biomedico e farmaceutico (2020). Edises ISBN 9788836230204 Serway-Jewett 2022 Edises ISBN 9788836230730 D. Halliday, R. Resnick- Fondamenti di Fisica. C.E.A. Milano ISBN 9788808067708 Bartolotta A.: Meccanica dei Fluidi. Edises ISBN 9788879598750
-------------------------------	--

SYLLABUS

Hrs	Frontal teaching
6	REQUESTS AND COMPLEMENTS TO THE TOP SCHOOL PROGRAMS Natural numbers, whole, rational, real. Approximate value of an irrational number. Elementary functions absolute value, power, root, exponential, logarithm. Scientific notation; Numerical calculations and percentages. Rational first and second degree rational equations and inequalities; Exponential and logarithmic equations and inequalities; Systems of inequalities. The trigonometric functions are breast, cosine, tangent, cotangent. Reverse trigonometric functions. Relationship between the elements of a rectangle triangle. Cartesian reference orthogonal system. Equation of the straight; Geometric significance of the angular coefficient of the straight; Corner between two straight lines; Condition of parallelism and of Perpendicularity between straight lines. Second order algebraic curves. Equation of the circumference, the ellipse, the parabola, the hyperbola. Sets operations (union, difference, intersection).
3	REAL VARIABLE REAL FUNCTION LIMITS Upper and lower extremes of a set of real numbers; Maximum and minimum. Limited and unlimited intervals. Around a number. Definition of a finished limit for one function at a point. Left and right limit. Definition of infinite limit for one function at a point. Definition of limit for an infinite function. Expressions of the theorems: the uniqueness of the limit, the permanence of the sign, of the comparison. Some remarkable limits; the number is". Indefinite forms. Limit Operations: Sum of limit, difference, product, quotient of functions.
3	CONTINUOUS FUNCTIONS Definition of continuous function at a point and interval. Examples of continuous function. Expressions of theorems: existence of zeros, existence of intermediate values, Weierstrass. Points of discontinuity: of the first species, of second species, can be eliminated.
5	DERIVATIVE OF REAL FUNCTION OF A REAL VARIABLE Definition of derivative. Straight tangent and geometric meaning of the derivative. Derivative of the most common functions. Derivative of sum, difference, product, quotient of functions. Composite function derivation rules. Top Derivatives. Theories of Fermat, Rolle, Lagrange, with corollaries. Rule of De L'Hospital. Differential of a function and its geometric meaning.
3	GRAPHIC DESIGN OF A FUNCTION Domain and coding of a function. Extreme of a function. Monotonous functions. Equal, Odd, Periodic Functions. Graphic representation of the numeric values of a function. Logarithmic and semi-logarithmic scales. Composite functions. A monotony criterion for a function. Relative and absolute maximum and minimum. Concave, convulsive and flush. Asymptotes. Full function chart of a function.
4	INTEGRAL REAL FUNCTION OF A REAL VARIABLE Indefinite integral. Immediate indefinite integrals. Integration methods. Defined integral and its geometric meaning. Integral function. Theorem of fundamental calculus. Calculation of areas.
3	ORDINARY DIFFERENTIAL EQUATIONS General Definition and Classification of Differential Equations. General solution of a differential equation; Initial conditions and particular solution. Linear differential equations of the first order. First-order differential equation resolution with separable variables. Equal linear equations of the second order with constant coefficients; Resolution techniques. Differential equations and mathematical models; Application examples. DIFFERENTIAL CALCULATION FOR REAL FUNCTION OF MORE REAL VARIABLES Definition of function of two or more variables. Domain and Cartesian representation for real function of two real variables. Partial derivative; Total differential; Successive derivatives. Exact differential forms.
3	PHYSICAL GRANTS AND THEIR MEASUREMENT Sum, difference and breakdown of vectors; Scalar product and vector product. Definition of physical size and unit of measurement; Scalar quantities and vector sizes; The International Unit of Measurement Unit. Methodology and meaning of the physical measurement process. Correct interpretation of the result of an experimental measure; Random uncertainties and systematic uncertainties

SYLLABUS

Hrs	Frontal teaching
9	Location, Movement, Speed, Acceleration. Hourly law and graphic representation of some simple types of motion. Inertial mass; power; The laws of dynamics; Forces fields; The fundamental interactions. Breakdown and sum of forces, free body diagram; Examples of troubleshooting dynamic issues. Convincing reactions; Static and dynamic friction force. Work, energy, power; Kinetic energy theorem. Fields of conservative forces; Potential energy and conservation of mechanical energy; The force as a gradient of potential energy; Energy diagrams; Quantization of energy. The gravitational field; Gravitational mass; Equivalence between inertia mass and gravitational mass; Gravitational potential energy; Weight of a body; Bulk density and specific weight. Circular circular motion, acceleration and centripetal force; angular speed;
9	FLUID MECHANICS Balance in fluids; Volume forces and surface forces; pressure; Isobaric surfaces; principle Of Pascal, Stevin's Law; Archimedes Law. Motion of ideal fluids; Flow and continuity equation; Bernoulli's theorem. Motion of real fluids, viscosity; Laminar motion; Hydraulic resistance; Law of Hagen-Poiseuille; Conducted in series and in parallel. Viscosity measurement: Oswald viscometer. Motion of a solid in a viscous fluid; Stokes law; Sedimentation velocity.
2	SURFACE SURFACE IN LIQUID Surface tension; Measurement methods. Law of Laplace; Capillary phenomena, Jurin law.
10	THERMODYNAMICS Temperature; Thermometer scales; thermometry; Thermal equilibrium. Thermodynamic system; State variables, intensive, extensive; Conditions for thermodynamic equilibrium; Ideal gas state equation. Static thermodynamic transformations and their graphic representation. Thermodynamic work; Operational definition of internal energy; The heat and the first law of thermodynamics; Heat transfer mechanisms. Thermal capacity; Specific heat; Molar heat. State changes; Latent heat; Evaporation, saturated vapor pressure and boiling. Elements of ideal kinetic theory; Microscopic interpretation of thermodynamic variables; Maxwell's distribution of molecular speeds; Calculation of the molar calories for the ideal gas; Energy equivalence. Applications of the First Ideal Gas Law. Entropy and the second law of thermodynamics; Thermal machines; The Carnot cycle. The irreversibility of natural processes; Increased entropy and disorder.
8	ELECTROMAGNETISM Electrostatic in vacuum; Electrostatic field; Electrostatic field produced by a point charge and Coulomb law. Electrostatic potential; The electrostatic field as a potential gradient. Overlapping principle; Electrostatic field produced by charge distributions: sheet, straight wire, sphere. The electric dipole; Dipole moment; Motion and potential energy of a dipole in an electric field. Dielectric substances; The dielectric constant; Polarization for orientation and induced polarization. Electrostatic field and charge distribution in conductors. Capacity of a conductor; capacitors; Capacity of a capacitor; Stored energy In the electrostatic field. Electrical conduction in solids; Intensity of electric current. Ohm's reading; Series and parallel resistors. Joule's current thermal effect and law. Magnetostatic in vacuum; Magnetic phenomena; Second Laplace formula and operational definition of the magnetic field. Motion of an electric charge in a magnetic field, Lorentz's strength; The mass spectrometer. Laplace's first formula; Biot and Savart formula; Definition of ampere; Stream loop in a magnetic field; Moment of magnetic dipole. Magnetic properties of matter; Orbital and spin magnetic moment; Quantization of angular momentum and magnetic moment; Diamagnetism, paramagnetism, ferromagnetism; Nuclear magnetic moment; Magnetic resonance imaging. Electromagnetic induction; Electromagnetic waves; Propagation speed of electromagnetic waves; Corpuscular nature of electromagnetic waves; Energy transported by an electromagnetic wave.
Hrs	Practice
6	Exercise on the topics discussed
12	Exercise on topics and resolution of exercises