UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2023/2024
BACHELOR'S DEGREE (BSC)	ROBOTICS ENGINEERING
SUBJECT	PHYSICS II
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50284-Fisica e chimica
CODE	07811
SCIENTIFIC SECTOR(S)	FIS/01
HEAD PROFESSOR(S)	REALE MARCO Professore a contratto Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	96
COURSE ACTIVITY (Hrs)	54
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	2
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**REALE MARCO** Monday 15:00 17:00 studio del docente (Dipartimento di Fisica e Chimica, Via Archirafi 36) e previo appuntamento

DOCENTE: Prof. MARCO REALE

PREREQUISITES	Excellent knowledge of the topics covered in the courses of Physics 1 and Calculus 1.
LEARNING OUTCOMES	and understanding: Acquisition of the theoretical foundations of classical electromagnetism and mastery of its basic logical-mathematical framework. Acquisition of the basic tools to face and solve problems of electromagnetism. Ability to use the specific language of this basic discipline. Ability to apply knowledge and understanding: Ability to transfer into the operational reality the knowledge gained to reach the solution of technical problems that emerge in the field of professional engineering activity. Making judgments: Being able to evaluate autonomously and critically the implications of the physical laws studied. Communication skills: Ability to expose the physical principles of electromagnetism, and the results obtained from carrying out typical exercises, even to a non-expert audience. Be able to support the importance and highlight the applicative effects of the issues addressed. Learning skills: Achievement of a learning ability that allows him to undertake a subsequent path of deepening and updating of the topics covered. The basics acquired in the course allow the student to independently expand their knowledge, with positive effects on their professional field.
ASSESSMENT METHODS	The exam consists of a written test and, in case of passing the first, an oral test. The latter is optional in cases where the written test is sufficient to provide the teacher with sufficient elements for the evaluation of the student. In the event that it is not necessary to carry out the oral test, the result of the written test is recorded. The written test requires the student to carry out exercises similar to those addressed during the exercises of the course, motivating the theoretical bases of the procedures adopted. The evaluation, expressed in thirtieths, is assigned on the basis of the following scale: 18-22: Sufficient phenomenological understanding of the concepts addressed during the course, and ability to express them with correct language. Sufficient ability to apply the concepts learned to the quantitative resolution of exercises that represent real situations. 23-27: Good understanding of the concepts addressed during the course, both from a phenomenological and quantitative point of view. Good communication skills and to illustrate the concepts learned with rigorous language. Good ability to apply the concepts learned to the quantitative resolution of exercises that represent real situations. 28-30L: Excellent qualitative and quantitative understanding of the concepts covered in the course, and excellent ability to apply them to the resolution of exercises that represent real situations. Excellent language properties. Ability to apply physical concepts even to situations slightly different from those covered during the course.
EDUCATIONAL OBJECTIVES	Understand the fundamental physical principles and the logical-mathematical framework at the base of classical electromagnetism: electrostatics, magnetostatics, electromagnetism. To achieve the mastery of Maxwell's equations in integral and differential form and their application to concrete situations.
TEACHING METHODS	The teacher provides students with lectures with the use of the blackboard, aimed at illustrating the main theoretical concepts of the course and their applications to real situations and application interest in engineering. The presentation of the topics is continuously accompanied by exercises that contribute to improving the students' ability to understand and apply the concepts covered.
SUGGESTED BIBLIOGRAPHY	Testi base: 1) P. Mazzoldi, M. Nigro, C. Voci, "Fisica - Elettromagnetismo e Onde - Vol II". ISBN: 9788879591522. e-book disponibile presso UniPa Discovery Service Oppure 2) S. Focardi, I. Massa, A. Uguzzoni, M. Villa, "Fisica Generale - Elettromagnetismo". ISBN: 978-88-08-32015-5. e-book disponibile presso UniPa Discovery Service Raccolte di esercizi consigliate:

	1) P. Pavan, P. Sartori, "Problemi di FIsica Risolti e Commentati 2", Casa Editrice Ambrosiana 2) M. Bruno, M. D'Agostino, R. Santoro - "Esercizi di Fisica - Elettromagnetismo", Casa Editrice Ambrosiana 3) M. Nigro, C. Voci, "Problemi di fisica generale. Elettromagnetismo - Ottica", 1995 Libreria Cortina. 4) L. Lotvich, S. Rosati, "Problemi di Fisica Generale" - Elettricità e Magnetismo, Casa Editrice Ambrosiana

SYLLABUS

Hrs	Frontal teaching
4	Electric charge. Insulators and conductors. Electric field. Electric field force lines. Electrostatic field produced by a charge distribution. Motion of an electric charge in an electric field. Electrostatic field flow. Gauss's law and its applications.
4	Vector fields. Gradient, divergence, rotor. Poisson and Laplace equations. Application to the electrostatic field.
6	Potential energy and electric potential. Equipotential surfaces. Potential for a charge distribution. Electric dipoles and multipoles. Electrostatic field energy. Electrical conductors at equilibrium. Capacitors. Capacity. Electrostatic screen. Forces between conductors.
4	Equations of electrostatics in the presence of dielectrics. Dielectric constant. Electric induction polarization vectors. Discontinuity of fields at the separation surface between dielectrics. Electrostatic energy of dielectrics. Forces on dielectrics. Microscopic polarization mechanisms (outline).
2	Electrical conduction. Electric current. Charge preservation. Ohm's law. Electrical resistance. Joule effect. Resistors in series and parallel. Electromotive force. Kirchhoff's laws.
6	Magnetic forces. Magnetic field. Lorentz force. Lines of force, circuitry and divergence of the magnetic field. Forces and moments acting on circuits. Ampere's law. Magnetic field produced by a circuit. Flow, self-flow, mutual induction and self-induction. Vector potential.
2	Magnetism in matter. Magnetization and H-field. Discontinuity of fields at the surface between two magnetized media. Diamagnetic, paramagnetic, ferromagnetic substances.
6	Electromagnetic induction. Faraday's law. Induced electromotive force and its applications. Magnetic energy of coupled circuits. Energy conservation in the presence of electromagnetic induction phenomena.
4	Displacement current. Ampere-Maxwell law. Maxwell's equations in differential and integral form. Notes on electromagnetic waves.

Hrs	Practice
4	Electrostatic exercises: field and potential produced by arbitrary charge distribution. Forces acting on electric charges and dipoles. Motion of charges in electric fields. Conductors in electrostatic equilibrium. Forces between conductors. Calculation of induced charge distributions on metal surfaces.
3	Electrostatics in the presence of dielectrics. Calculation of induced charge distributions on dielectric surfaces. Forces acting on dielectrics.
4	Exercises: calculation of the magnetic field produced by a current distribution. Calculation of forces and moments acting on circuits. Calculation of mutual and self-induction coefficients.
5	Exercises: electromagnetic induction phenomena and their applications. Notes on electrical oscillations and RLC circuits.