UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2022/2023
BACHELOR'S DEGREE (BSC)	BIOMEDICAL ENGINEERING
SUBJECT	PHYSICS II
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50293-Fisica e chimica
CODE	07870
SCIENTIFIC SECTOR(S)	FIS/01
HEAD PROFESSOR(S)	BASILE SALVATORE Professore Associato 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	**BASILE SALVATORE** Tuesday 15:00 17:00 Viale delle Scienze, Edificio 6 (ex DIN), stanza 213. Nel periodo di non svolgimento di attivita didattica in presenza si svolge su piattaforma Teams, previa prenotazione via email. Thursday 15:00 17:00 Viale delle Scienze, Edificio 6 (ex DIN), stanza 213. Nel periodo di non svolgimento di attivita didattica in presenza si svolge su piattaforma Teams, previa prenotazione via email.

DOCENTE: Prof. SALVATORE BASILE

PREREQUISITES	Good knowledge of the “Fisica I” and “Analisi Matematica” topics.
LEARNING OUTCOMES	Knowledge and understanding Theoretical understanding: have a good understanding of the principles of classical electromagnetism (logical and mathematical structure, experimental support, and described physical phenomena) and their applications to engineering. Mathematical skills: be able to understand and master the use of the most commonly used mathematical methods. This will be verified dring the written and oral test. Applying knowledge and understanding Problem solving skills: be able to evaluate clearly the orders of magnitude in situations which are physically different, but show analogies, thus allowing the use of known solutions in new problems. Be able to solve electricity and magnetism problems using first principles and the Maxwell’s equations both in differential and integral form. Modelling: be able to identify the essentials of a process / situation and to set up a working model of the same; be able to perform the required approximations. This will be verified dring the written and oral test. Making judgements Be able to identify the more effective way to the solution of electromagnetism problems using the fundamental laws and/or a conservation approach. Acquire an understanding of how electromagnetism laws are applicable to many fields, namely engineering. This will be verified dring the oral test. Communications skills Be able to describe, analyse and solve electromagnetism problems using appropriate technical language and be able of written and oral communication on related subjects. Be able to describe the logical flowchart of problem solving. Be able to improve the group working skills. This will be verified dring the oral test. Learning skills The student will learn the basic laws of classical electromagnetism and the typical methodology of the physical sciences, to be applied to engineering problems, critically and in an autonomous way. He will also improve the ability of autonomous learning. This will be verified dring the oral test.
ASSESSMENT METHODS	The exam consists of both a written and an oral test, evaluated on a 30 points scale. The final mark will take into account the outcome of both tests. Purpose of the tests: test the knowledge of the principles of classical electromagnetism and Maxwell’s equations and their application to solve electrostatics, magnetostatics and time-dependent fields problems. Check the ability of modelling and identifying the essential elements of a problem. Type of tests: written test (problems and exercises with symbolic or numerical answer, open- or closed-ended); passing the written test (at least 18/30) gives access to the oral exam (discussion of the written test and questions on general topics and / or exercises with reference to the recommended texts). The oral examination must be undertaken in the same exam session (“appello”) of the written test. The written test is a closed book one. Only a calculator and a formula sheet are allowed. Duration of the written exam: no more than 3 hours. EVALUATION CRITERIA Indicator - Knowledge and competence of contents Descriptor and score range: Excellent 10 Autonomous and effective 8-9 Acceptable 6-7 Fragmentary or partly superficial 4-5 Inadequate 0-3 Indicator - Applicative skill, precision, logical-thematic coherence Descriptor and score range: Excellent 10 Adequate 8-9 Acceptable also if partly driven 6-7 Limited 4-5 Inadequate 0-3 Indicator - Expression and terminology, reprocessing skills and multi-disciplinary connections Descriptor and score range: Excellent 10 Effective and well-structured 8-9 Generally satisfactory 6-7 Hesitant and rough 4-5 Inadequate 0-3
EDUCATIONAL OBJECTIVES	Have a good understanding of the principles of classical electromagnetism. Be able to solve simple problems of electrostatics, magnetostatics and classical electromagnetism, applying first principles and Maxwell's equations.

TEACHING METHODS	Lectures. Instructor-assisted resolution of exercises and problems. Classwork, for single students or groups. Teaching tools: blackboard, chalk sticks, blackboard eraser; computer and video projector.
SUGGESTED BIBLIOGRAPHY	Appunti delle lezioni e materiale didattico fornito dal docente. Si può utilizzare qualunque testo universitario di Fisica Generale (Elettromagnetismo) per i corsi di Ingegneria. Di seguito una lista, non esaustiva, di possibili scelte. P. Mazzoldi, M. Nigro, C. Voci, "Fisica Vol. II - Elettromagnetismo e onde", III / 2021, EdiSES, ISBN 9788836230303. P. Mazzoldi, M. Nigro, C. Voci, "Elementi di Fisica - Elettromagnetismo e Onde", III / 2022, EdiSES, ISBN 9788836230273. S. Focardi, I. Massa, A. Uguzzoni, M. Villa, "Fisica Generale, Elettromagnetismo", II / 2021, CEA, ISBN 9788808320155. R.A. Serway, J.W. Jewett, "Fisica per Scienze ed Ingegneria, Volume 2", V / 2015, EdiSES, ISBN 9788879598248. Ultima edizione in inglese: R.A. Serway, J.W. Jewett, “Physics for Scientists and Engineers, Volume 2, 10th Edition”, 2019, Cengage, ISBN 9781337553582. D.J. Griffiths, “Introduction to Electrodynamics”, 4th ed., 2013, Pearson, ISBN 9788120347762. E.M. Purcell, D. J. Morin, “Electricity and Magnetism”, 3rd ed., 2013, Cambridge, ISBN 9781107014022. Libri di consultazione per applicazioni specifiche. D. Scannicchio, "Fisica Biomedica", IV / 2020, Edises, ISBN 9788836230198. Libri di testo e manuali accessibili da Unipa (in dipendenza dell'anno accademico). Textbooks and reference books freely accessible from Unipa (depending on the academic year). W. Demtröder, "Electrodynamics and Optics", 2019, Springer, ISBN 9783030022891. https://link.springer.com/book/10.1007/978-3-030-02291-4 A. Bettini, "A Course in Classical Physics 3-Electromagnetism", 2016, Springer, ISBN 9783319408705. https://link.springer.com/book/10.1007/978-3-319-40871-2 F. Salazar Bloise et al., "Solved Problems in Electromagnetics", 2017, Springer, ISBN 9783662483664. https://link.springer.com/book/10.1007/978-3-662-48368-8 Libri di esercizi e problemi. F. Porto, G. Lanzalone, I. Lombardo, "Problemi di Fisica Generale, Elettromagnetismo e Ottica", 2014, Edises, ISBN 9788879598378. S. Longhi, M. Nisoli, R. Osellame, S. Stagira, "Fisica Generale: Problemi di Meccanica, Termodinamica, Elettricità e Magnetismo", 2017, Esculapio. ISBN 9788893850452. Siti consigliati: http://www.compadre.org/osp/search/browse.cfm?browse=gsss http://www.sc.ehu.es/sbweb/fisica/ https://www.compadre.org/physlets/

SYLLABUS

Hrs	Frontal teaching
4	ELECTROSTATICS. Electric charges. Insulators and conductors. Structure of matter. Coulomb's law. Electrostatic field. Point charges. Electrostatic field of continuous charge distributions. Electrostatic field lines. Motion of a charge in an electrostatic field. Flux of the electrostatic field. Gauss's law. Vector fields. Gradient, divergence and curl in Cartesian and curvilinear coordinates.
4	ELECTROSTATIC POTENTIAL. Electric potential and voltage. Potential of continuous charge distributions. Electrostatic potential energy. The field as the potential gradient. Equipotential surfaces. Circulation and rotor of the electric field. The electric dipole. Dipole field. Multipoles. Electric dipole in an external field. Poisson’s and Laplace’s equations.
4	CONDUCTORS AND DIELECTRICS. Conductors in equilibrium. Hollow cavities in conductors. Electrostatic shield. Capacitors. Connection of capacitors. The electrostatic field energy. Dielectrics. The dielectric constant. Polarization of dielectrics.
4	ELECTRIC CURRENT. Conduction current. Stationary electric current. Ohm's law. Classical model of conduction. Series and parallel combinations of resistors. Electromotive force. Kirchoff's laws. Charge and discharge of a capacitor. RC circuit.
3	MAGNETIC FIELD. Magnetic interaction. Magnetic field. Magnetic force and motion in a magnetic field. Magnetic force on a current-carrying conductor. Torque on circuits. Magnetic dipole moment. Hall effect.
4	MAGNETIC FIELDSOURCES. Magnetic field produced by a current. Magnetic field of some specific sources. Magnetic force between current-carrying wires. Ampère's law. Magnetic fields in matter. Gauss's law for magnetism.

SYLLABUS

Hrs	Frontal teaching
4	ELECTRODYNAMICS. Faraday's law. Induced electric field. Motional electromotive force. Self-inductance, RL circuits. Magnetic energy. Mutual inductance.
3	MAXWELL'S EQUATIONS. Displacement current. Ampère-Maxwell law. Maxwell's equations and their differential and integral form. Elements on wave characteristics and behaviour. Wave solution of Maxwell's equations. Plane waves. Energy and momentum of electromagnetic waves. Poynting vector. Radiation pressure. Intensity. EM waves spectrum.

Hrs	Practice
3	ELECTROSTATICS.
3	ELECTROSTATIC POTENTIAL.
3	CONDUCTORS AND DIELECTRICS.
3	ELECTRIC CURRENT.
3	MAGNETIC FIELD.
3	MAGNETIC FIELD SOURCES.
3	ELECTRODYNAMICS.
3	MAXWELL'S EQUATIONS.