



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2021/2022
BACHELOR'S DEGREE (BSC)	BIOMEDICAL ENGINEERING
SUBJECT	BIOIMAGING
TYPE OF EDUCATIONAL ACTIVITY	C
AMBIT	10657-Attività formative affini o integrative
CODE	18411
SCIENTIFIC SECTOR(S)	MED/36
HEAD PROFESSOR(S)	CANNELLA ROBERTO Ricercatore a tempo determinato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	3
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	CANNELLA ROBERTO Wednesday 09:00 - 14:00 Policlinico Paolo Giaccone, Servizio Centralizzato di Diagnostica per Immagini, Primo Piano.

DOCENTE: Prof. ROBERTO CANNELLA

PREREQUISITES	To Know the basic concepts of anatomy, physiology, chemistry and physics, with references to the characteristics of radiant energies. To know and manage the basic concepts of DICOM images reconstruction.
LEARNING OUTCOMES	To understand the fundamental concepts of biomedical imaging techniques, image processing and archiving, the interaction of ionizing radiation with biological matter and the fundamental characteristics and biodistribution of contrast media.
ASSESSMENT METHODS	The assessment of students' learning level will consist of a written test, through the solution of multiple closed questions, of which a correct one, proposals on topics covered in the course, to be completed in thirty minutes. To successfully pass the assessment of learning, the student must demonstrate, through the test, that he has understood the concepts presented in the course, thus possessing a basic knowledge of the technologies covered in the course, as well as having developed an adequate familiarity with the topics covered. A score between zero and thirty will be assigned to the written test. The overall grade, out of thirty, will be rounded upwards. Alternatively, the learning assessment may consist of an oral test: some questions will be asked to the student about the program with reference to the lessons and recommended texts. This verification will aim to assess if the student has knowledge and understanding of the topics covered, exhibition skills and arguments. The greater this knowledge and capacity, the more positive the evaluation will be. In order for the overall outcome of the assessment to be positive, the student must achieve at least the sufficiency, equal to eighteen points. The maximum evaluation will be achieved by demonstrating a thorough knowledge of the course contents. Praise will be reserved for students who have completed the written test or the oral exam correctly and completely. 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	An introduction to the current technology available in Medical Imaging will be given. This includes the scientific basis and physical principals underpinning imaging in medicine. Emphasis will be on Computerized Tomography, Ultrasound and Magnetic Resonance Imaging. Nuclear Medicine equipment, Scintigraphy, SPECT and PET, will also be introduced. The students will be introduced to the specific language of radiobiology, interactions between matter and radiation, and genetic basis of radiation damage. Physical properties and absorption timing of ionizing radiation, dosimetry, survival rate and timeline of cells, cellular alteration induced by radiation, health effect and radiation burn, and radiopathology will be stressed. In addition students will be introduced to basic electronics, electrotechnics, production of X-rays and construction of the Xray tube, and principles of electrical safety. By the end of the course the student will also know potentiality and clinical use of contrast media in common radiology modalities. Topics related to 2D and 3D medical image analysis algorithms will be covered. In the case of 3D, ray casting Volume Rendering techniques will be discussed.
TEACHING METHODS	Lessons and training
SUGGESTED BIBLIOGRAPHY	Elementi di tecnologia radiologica Autori: Passariello - Simonetti - Albanese - Bartolozzi - Bazzocchi - Zobel - Cassinis Editore: Idelson - Gnocchi Edizione: V - 2012 Volume: Unico

	ISBN-10: 8879475401 ISBN-13: 978-8879475402 Verranno indicati alcuni argomenti da approfondire mediante lo studio di passi scelti nel testo, da integrare con il materiale didattico fornito dal docente. Biomedical Imaging: Principles and Applications Reiner Salzer (Editor) ISBN: 978-0-470-64847-6 The book will serve as a guide and will be supplemented by teaching materials.
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SYLLABUS

Hrs	Frontal teaching
12	Radiobiology
4	X-rays production and X-ray tube
4	CT image production compared with conventional radiology, parameters affecting imaging quality.
4	CT scanners historical background, working principles up to last generation multirow scanner, scanner design, construction and operation.
3	2D and 3D medical image analysis algorithms
4	2D and 3D reconstruction (MPR, CPR, MIP, MiniP, VR, virtual endoscopy and volume rendering)
6	Ultrasound
12	Contrast agents classification and their potential and clinical use in common radiology modalities
10	Magnetic Resonance Imaging, signal genesis and main sequences
8	Nuclear Medicine equipment
8	Radiotherapy
Hrs	Practice
6	Training in CT and MR