UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Biomedicina, Neuroscienze e Diagnostica avanzata		
ACADEMIC YEAR	2023/2024		
BACHELOR'S DEGREE (BSC)	MEDICAL AND IMAGE DIAGNOSTICS AND RADIOTHERAPY TECHNIQUES		
INTEGRATED COURSE	STATISTICS, IMAGE PROCESSING AND FILING, PHYSICS - INTEGRATED COURSE		
CODE	13580		
MODULES	Yes		
NUMBER OF MODULES	3		
SCIENTIFIC SECTOR(S)	MED/01, ING-INF/05, FIS/07		
HEAD PROFESSOR(S)	ENEA MARCO	Professore Associato	Univ. di PALERMO
OTHER PROFESSOR(S)	FRANCHINI SILVIA GIUSEPPINA	Professore a contratto	Univ. di PALERMO
	ENEA MARCO	Professore Associato	Univ. di PALERMO
	ANSELMO SARA	Ricercatore a tempo determinato	Univ. di PALERMO
CREDITS	9		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	1		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**ANSELMO SARA**		
	Monday 15:00 17:00 Viale delle Scienze. Ed. 18. Studio del docente		
	ENEA MARCO		
	Monday 15:00 17:00 Dipartimento PROMISE - Sezione di Igiene - Universita degli Studi di Palermo - Via del Vespro, 133, Palermo. Stanza del Docente. Si consiglia di contattare il docente per un appuntamento.		
	FRANCHINI SILVIA GIUSEPPINA		
	Friday 11:00 12:00 Su appuntamento		

DOCENTE: Prof. MARCO ENEA

PREREQUISITES	Basic elements of mathematics; algebraic equations. Logarithms; elements of trigonometry. Cartesian coordinates. Graphs.
LEARNING OUTCOMES	Knowledge and understanding. Students will be able to understand the basic concepts underlying the information/communication technologies that act as a support to diagnostic procedures. The working principles of hardware, software and networked computer systems will be exposed, with particular emphasis to Radiology Information Systems (RIS) and Picture Archiving and Communication System (PACS). In this respect, the student will have a general knowledge and understanding of the techniques commonly used for increasing the quality of digital radiological images. Students will also be able to understand the basic concepts of general physics underlying the often very sophisticated instruments used in medical diagnostics and radiotherapy. Examples are the mechanics of point material bodies, fluid mechanics, thermology and basic thermodynamics, as well as basic concepts of electricity, magnetism and electromagnetic fields. Students will also be able to understand the basic principles of statistics and its use in the field of radiology, with particular emphasis on treatment and statistical analysis of data, probability theory, statistical sampling and elements of inferential statistics. Applying knowledge and understanding Students will be able to use simple computer systems, typically RIS and PACS. They will also acquire specific technical knowledge to perform simple manipulations (e.g. the gray scale) to improve the quality of radiological images. Students will apply the general physics knowledge to improve their understanding of the physical principles underlying the instruments and physical techniques used in medical school. They will also be able to perform statistical analysis of the data and to interpret the results obtained. Making judgements The student is expected to be able to study and work independently, with particular attention to the interdisciplinary aspects of knowledge Communication skills Ability to expose what they have learned in a written, oral or multi-medial way. Ability to communicate with experts in near fields. The student is expected to gain the communication methodology typical of the scientific/experimental approach in the fields of general physics, informatics, medical statistics. Learning skills The student will be able to study in an autonomous way an to apply the knowledge acquired to globally improve its professional standard; he is expected to read scientific publications typical of the medical field. The general physics modulus will provide the student with basic concepts essential in the fields of medical physics and radioprotection (physics of ionizing radiation and medical imaging). The statistics modulus will give basic knowledge essential to understand probability, statistical sampling, statistical inference with applications in radiology.
ASSESSMENT METHODS	Final written and / or oral exam. The final grade will be calculated as the average of the marks reported in the three modules that make up the integrated course. There Numerical evaluation will be carried out according to the following criteria: grade 18-23: sufficient preparation; grade 24-26: good preparation; grade 27-30: excellent preparation; grade 30 cum laude: excellent and brilliant preparation.
TEACHING METHODS	lecturers, exercises, practical

MODULE
MEDICAL STATISTICS

Prof. MARCO ENEA

SUGGESTED BIBLIOGRAPHY

Libro di testo
Triola MM Triola MF, Fondamenti di Statistica per le discipline biosanitarie. Pearson.
Traduzione italiana de "Biostatistics for the Biological and Health Sciences with Statdisk, 1st edition".
ISBN 9788891902580.

AMBIT	10337-Scienze propedeutiche
INDIVIDUAL STUDY (Hrs)	45
COURSE ACTIVITY (Hrs)	30

EDUCATIONAL OBJECTIVES OF THE MODULE

The course is aimed to introduce the statistical methodology useful to the skills of the health professional. Students will be introduced to the elementary concepts of descriptive and inferential statistics, probability calculation and measurement of accuracy of diagnostic tests.To enhance learning, students will be involved in working groups to carry out data analyses in excel and to present powerpoint slide on arguments assigned by the teacher.

SYLLABUS

Hrs	Frontal teaching
1	Sources and databases of health data
2	Basic concepts: qualitative and quantitative characters, discrete and continuous characters, scales of measurement: nominal, ordinal, intervals and ratio
2	Data presentation: frequency and quantity distributions. Graphical representations
4	Measures of mean and variability with exercises
4	Elements of probability theory. Bayes Theorem. Measures of accuracy of diagnostic tests. Roc Curves
3	Theoretical distributions: Gauss and Binomial distribution, with exercises
2	Central Limit Theorem. Sample distributions of sample mean, with exercises
2	Statistical estimate of the mean and confidence interval
2	Statistical tests of significance for the mean

Hrs	Practice
3	Practice on preparation of tables and graphics to describe and summarize data
2	Measures of accuracy of diagnostic tests. Roc Curves and area under the curve (AUC)
3	Exercises on statistical data with MS Excel

MODULE
GENERAL PHYSICS

Prof.ssa SARA ANSELMO

SUGGESTED BIBLIOGRAPHY	
F. Borsa, A. Lascialfari. Principi di fisica. Per indirizzo biomedico e farmaceutico. Edises; ISBN: 9788879598163 G.M. Contessa, G.A. Marzo. Fisica applicata alle scienze biomediche. Zanichelli; ISBN: 9788808820327	
AMBIT	10337-Scienze propedeutiche
INDIVIDUAL STUDY (Hrs)	45
COURSE ACTIVITY (Hrs)	30
EDUCATIONAL OBJECTIVES OF THE MODULE	
The aim of the course is to know the basic principles of mechanics, thermodynamics, fluid physics and electromagnetism. The student will be able to apply the laws studied on examples and exercises.	

SYLLABUS

Hrs	Frontal teaching
2	Introduction to the course and exam method. Physical quantities. Fundamental quantities and derived quantities - Units of measurement - Vectors and scalars - Sum of vectors - Product of vectors.
3	Material point. Speed. Acceleration. Trajectories and hourly laws of motion. Mototion in one and in two dimensions. Uniform rectilinear motion, uniformly accelerated motion, uniform circular motion.
4	Dynamics. Force. Mass. Forces of gravitational attraction. Strength-Weight. Tension of a rope. Elastic forces. Friction force. Static and dynamic friction.
6	Work and Energy. Work of a force. Kinetic energy. Potential energy. Mechanical energy of a physical system. Conservative forces. Conservation of mechanical energy. Power mechanics. Momentum. Impulse of a force. Elastic and inelastic collisions.
6	Fluids. Properties of liquids. Density. Specific weight. Stevin's law. Pascal's law. Archimedes' principle. Dynamics of ideal and real fluids and their applications.
4	Thermodynamics: calorimetry and principles of thermodynamics.
5	Electrostatics: electric forces and Coulomb's law, electric fields, electric potential, conductors and insulators. Magnetic phenomena: Lorentz force, Ampere's theorem. Fundamentals of optics and electromagnetic waves.

MODULE
IMAGE PROCESSING AND FILING SYSTEMS

Prof.ssa SILVIA GIUSEPPINA FRANCHINI

SUGGESTED BIBLIOGRAPHY

1) D. Sciuto, G. Buonanno, L. Mari; Introduzione ai sistemi informatici, 5/ed, ISBN: 8838668329, McGraw-Hill.
2) R.C. Gonzalez, R.E. Woods; Elaborazione delle Immagini Digitali, 3/ed., ISBN: 8871925068, Prentice Hall.
3) Dispense integrative e lucidi curati dal docente.

AMBIT	10353-Scienze interdisciplinari
INDIVIDUAL STUDY (Hrs)	45
COURSE ACTIVITY (Hrs)	30

EDUCATIONAL OBJECTIVES OF THE MODULE

The course aims at providing basic knowledge associated to the Information and Communication Technology, as a useful support for medical imaging. The course offers an introduction to computer systems, analysing the related basic operating principles of its infrastructures: the hardware, the software, and the network infrastructures. Further details will be provided on RIS (Radiology Information System) and PACS (Picture Archiving and Communication System). The course will also introduce the concept of digital image, the impact of spatial and grey level resolution on its quality, and it will present the common used techniques for medical image filtering and quality enhancement.

SYLLABUS

Hrs	Frontal teaching
3	Course introduction; Information representation and processing.
3	Hardware Infrastructure: introduction to computer architetture; central processing unit; memory systems; I/O devices.
3	Software Infrastructure: features and purposes of an operating system; major components of an operating system.
3	Network Infrastructure: data and information transmission; computer networks; a brief introduction to TCP/IP.
5	Information Systems and Database. RIS (Radiology Information System) and PACS (Picture Archiving and Communication System).
2	DICOM and HL7 standards.
3	Digital Images.
3	Digital Image representation. The impact of spatial and grey level resolution on digital image quality.
5	Digital image processing techniques.