INTEGRATED COURSE: INFORMATION TECHNOLOGY, STATISTICS AND PHYSICS APPLIED TO RADIOLOGICAL SCIENCE
SSSD: MED/01, INF/01, ING-INF/05, FIS/07
CFU: 8
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MODULE: Medical Statistics Applied to radiological sciences
SSD: MED/01
CFU: 1
PROFESSOR: Monica Sache Schepisi e-mail: monica.sacheschepisi@unicamillus.org

MODULE: Information Technology applied to Radiological Sciences
SSD: INF/01
CFU: 2
PROFESSOR: Luca Del Greco e-mail: luca.delgreco@unicamillus.org

MODULE: Elaborazione dati e archiviazione/Data Processing and storage
SSD: ING-INF/05
CFU: 2
PROEFSSOR: Luca Del Greco e-mail: luca.delgreco@unicamillus.org

MODULE: Fisica di base/Basics of Physics
SSD: FIS/07
CFU 1
PROFESSOR: Andrea Bellome e-mail: andrea.bellome@unicamillus.org

MODULE: Fisica delle radiazioni/Physics of radiations
SSD: FIS/07
CFU 2
PROFESSOR: Paolo Calligari e-mail: paolo.calligari@unicamillus.org

PREREQUISITES

Although there are no prerequisites, minimum basic knowledge of mathematics, physics and basic statistics are required.

LEARNING OBJECTIVES

It is an essential objective of this teaching to learn the knowledge of the essential elements of medical statistics which include: parameters for descriptive analysis (average, median, fashion and

frequency measurement of the distribution of categorical variables), parameters for the analysis of variability (variance , standard deviation and confidence intervals) and elements of inferential statistics (use and interpretation of the most common statistical tests), introduction to regression techniques. The course aims to provide the student with the skills necessary to understand the key role that Information Technology (IT) plays for today's society and, in particular, in the technical-health professions. The course aims to provide the student with the skills necessary to understand the role played by information systems, illustrating the development process of these systems and focusing attention on data management systems. The aim of the Basic Physics and Radiation Physics course within the integrated course of Computer Science, Statistics and Physics applied to Radiological Sciences is to provide students with the knowledge on the foundations of applied physics necessary for the performance of their future activity. In particular, the understanding of the physical principles underlying medical physics and the functioning of medical instrumentation will be addressed. At the end of the course, students will know the fundamental concepts of application of the scientific method to the study of biomedical phenomena (choice and measurement of parameters, evaluation of errors), they will be able to describe the physical phenomena of complex systems using appropriate mathematical tools, they will know the scientific bases of medical procedures and the operating principles of equipment commonly used for diagnostics and therapy.

LEARNING OUTCOMES

knowledge and understanding

At the end of this course the student will have to know:
Classify the variables according to their form; understand and calculate the extent of the distribution of different variables; understand and calculate the measure of sample variability; design and analyze clinical studies using binary variables; make a comparison between continuous variables; address the concept of model in inferential statistics; use simple linear regression models; use multiple linear regression models for the analysis of confounders; use nonlinear models (logistic regression). basic knowledge of the characteristics of modern IT systems, an understanding of the main applications of IT systems, the elements that contribute to defining the architecture of an IT system in terms of the relative hardware and software components that compose them, the difference between base and application software, the use of software to specify the actions that a computer must perform, the social impact of computers and IT technologies. what computer systems are and why they are needed. The different types of IT systems commonly adopted in companies and their purposes, the development cycle (life cycle) of an IT system, a basic knowledge of programming languages and coding, the different approaches to software development (oriented objects, structured, etc.), what are databases and database management systems. Having understood the experimental method and having acquired the rigor in the use and transformations of the units of measurement. Know and correctly understand the terminology of physics. Know the fundamental principles and laws of physics concerning kinematics, dynamics, electricity and magnetism, vibrations and waves, radiation and nuclear physics. Apply these concepts to biological and physiological phenomena in living organisms. Identify and recognize the physical principles that regulate the function of specific human organs.

Applying knowledge and understanding

At the end of the course, the student will be able to use the knowledge acquired for the deepening of elementary aspects relating to the use of statistics in the radiological field and to relate knowledge of causes with other professionals in the health sector. Apply the principles of physics to selected problems and to a variable range of situations. Use the tools, methodologies, language and conventions of physics to test and communicate ideas and explanations.

communication skills

At the end of the course, the student must know:
express yourself using specific scientific terminology. Use the appropriate scientific and technical terminology also in relation to the different radiological techniques. How to properly use the terminology commonly adopted in the IT world.

making judgements

At the end of the course, the student will have to know how to carry out general assessments of the potential of medical statistics in both care and clinical research. Adequate knowledge and skills to be familiar with IT systems and their components. Adequate knowledge and skills to be familiar with IT systems, database management systems and their life cycles. Identify the fundamental role of correct theoretical knowledge of the subject in clinical practice.

COURSE SYLLABUS

MEDICAL STATISTICS APPLIED TO RADIOLOGICAL SCIENCES

- *Variables: continuous, binary, ordinal, categorical.*
- *Inferential statistics on results and exposures.*
- *Average, median, modality, variance, standard errors and proportion.*
- *Line regression model*
- *Multiple regression and confounding model*
- *Nonlinear regression models. Nucleic acids. DNA and RNA. Transcription and translation. Regulation of gene expression.*
- *Cell cycle. Types of cell division in prokaryotes and eukaryotes (mitosis and meiosis).*
- *Protein biosynthesis.*

INFORMATION TECHNOLOGY APPLIED TO RADIOLOGICAL SCIENCES

- *Introduction to IT systems*
- *IT system hardware (CPU, memory, Input / Output)*
- *IT systems software: system software (operating system and utilities), application software (word processing, spreadsheets, databases, etc.)*

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DATA PROCESSING AND STORAGE

- *Introduction to information systems*
- *Types of information systems*
- *The life cycle of information systems*
- *Database and Database Management System (DBMS)*

BASICS OF PHYSICS

- *Introduction, measurement, estimating*
- *Describing motion: kinematics in one dimension*
- *Two-dimensional kinematics; Vectors*
- *Dynamics: Newton's laws of motion*
- *Circular motion; Gravitation*
- *Work and Energy*
- *Oscillations and waves*

PHYSICS OF RADIATIONS

- *Electric charge and electric field*
- *Electric potential*
- *Electric currents*
- *DC circuits*
- *Magnetism*
- *Electromagnetic induction and Faraday's law*
- *Electromagnetic waves*
- *The wave nature of light*
- *Optical instruments*
- *Early quantum theory and models of the atom*
- *Nuclear physics and radioactivity*
- *Nuclear energy; Effects and uses of radiation*

COURSE STRUCTURE

*The module of **Information Technology, Statistics and Physics Applied to Radiological Science** is organized in lectures for a total of 80 hours and theoretical-practical exercises. The teachers use Power Point presentations to deal with the teaching topics.*

COURSE GRADE DETERMINATION

The exam is unique for the entire integrated course, it is not possible to take exam tests for the individual modules.
Learning outcomes will be assessed through a multiple-choice written test and a final oral exam. The oral exam will consist of some questions, aimed at verifying both the knowledge of purely theoretical elements and the calculation of parameters or the interpretation of study results. During

the oral exam, the examining commission will evaluate the student's ability to apply knowledge and will ensure that the skills are adequate.
The final exam grade will be calculated as the average of the written grade and the individual oral tests taken according to the following criteria:

***Not suitable**: Poor or lacking knowledge and understanding of the topics; limited capacity for analysis and synthesis, frequent generalizations of the requested contents; inability to use technical language.*
***18-20**: Just sufficient knowledge and understanding of the topics, with obvious imperfections; just sufficient capacity for analysis, synthesis and autonomy of judgment; poor ability to use technical language.*
***21-23**: Sufficient knowledge and understanding of the topics; sufficient ability to analyze and synthesize with the ability to reason with logic and coherence the required contents; sufficient ability to use technical language.*
***24-26**: Fair knowledge and understanding of the topics; discrete ability to analyze and synthesize with the ability to rigorously argue the required contents; good ability to use technical language*
***27-29**: Good knowledge and understanding of the required contents; good ability to analyze and synthesize with the ability to rigorously argue the required contents; good ability to use technical language.*
***30-30L**: Excellent level of knowledge and understanding of the required contents with an excellent ability to analyze and synthesize with the ability to argue the required contents in a rigorous, innovative and original way; excellent ability to use technical language*

OPTIONAL ACTIVITIES

Students will have the opportunity to carry out theoretical / practical exercises and participate in seminars. The teachers will provide constant support during and after the lessons. In addition to the teaching activity, the student will be given the opportunity to take advantage of tutoring on request.

READING MATERIALS

MEDICAL STATISTICS APPLIED TO RADIOLOGICAL SCIENCES:

Epidemiology: Beyond the Basics / Edition 4 by Moyses Szklo, F. Javier Nieto
ISBN-10: 128411659X; ISBN-13: 9781284116595; Pub. Date: 05/02/2018; Publisher: Jones & Bartlett Learning

INFORMATION TECHNOLOGY APPLIED TO RADIOLOGICAL SCIENCES:

Deborah Morley and Charles S. Parker, *Understanding Computers: Today and Tomorrow (16th edition)* - Cengage Learning

DATA PROCESSING AND STORAGE:

Deborah Morley and Charles S. Parker, *Understanding Computers: Today and Tomorrow (16th edition)* - Cengage Learning

BASICS OF PHYSICS AND PHYSICS OF RADIATIONS:

Douglas C. Giancoli "PHYSICS: Principles with Applications" Seventh edition or subsequent, Pearson Education. Inc

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