DEGREE IN RADIOLOGY, DIAGNOSTIC IMAGING AND RADIOTHERAPY TECHNIQUES

Integrated Course: INFORMATION TECHNOLOGY, STATISTICS AND PHYSICS APPLIED TO RADIOLOGICAL SCIENCE

SSD: 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 name: Simone Lanini e-mail: simone.lanini@unicamillus.org

MODULE: Information Technology applied to Radiological Sciences
SSD: INF/01
CFU: 2
Professor name: Paolo Bocciarelli e-mail: paolo.bocciarelli@unicamillus.org

MODULE: Data Processing and storage
SSD: ING-INF/05
CFU: 2
Professor name: Paolo Bocciarelli e-mail: paolo.bocciarelli@unicamillus.org

MODULE: Basics of Physics and Physics of radiations
SSD: FIS/07
CFU 3
Professor name: Iole Indovina e-mail: iole.indovina@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

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

MODULE: 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 modelsNucleic 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.*

MODULE: 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.)

MODULE: Data Processing and storage

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

MODULE: Basics of Physics and Physics of radiations

- *Introduction, measurement, estimate:*
- *Description of the movement: kinematics in one dimension*
- *two-dimensional kinematics; Vettori*
- *Dynamics: Newton's laws of motion*
- *Circular movement; Gravitation*
- *work and energy*
- *Electric charge and electric field*
- *Electric potential*
- *Electric currents*

- *DC circuits*
- *Magnetism*
- *Electromagnetic induction and Faraday's law*
- *Vibrations and waves*
- *Electromagnetic waves*
- *the wave nature of light*
- *The visible spectrum and dispersion*
- *Optical instruments*
- *Nuclear physics and radioactivity*
- *First quantum theories and atom model.*
- *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

MODULE: Medical Statistics Applied to radiological sciences

The preparation of the students will be verified with an oral test. The oral test will consist of 3 questions, the first of which on a topic chosen by the student. During the test, knowledge of purely theoretical elements may be verified, the calculation of parameters or the interpretation of study results may be requested. During the oral exam, the examining commission will evaluate the student's ability to apply knowledge and will ensure that the skills are adequate to interpret the fundamental parameters for assessing the accuracy of a diagnostic test in the medical field.

MODULE: Information Technology applied to Radiological Sciences

The acquisition of the expected learning outcomes will be ascertained through a written test.

MODULE: Data Processing and storage

Written test in the form of multiple-choice tests.

MODULE: Basics of Physics and Physics of radiations

The Physics test consists of a compulsory written test and an optional oral test. The written and oral tests are aimed at evaluating both the theoretical knowledge and the student's ability to solve problems. The written test consists of 15 multiple choice questions.
Each correct answer gets a score of 2/30, while there is no penalty for the wrong answers. Only students who have obtained a written test of at least 12/30 are admitted to the oral exam.
Mark less than 12 in the written test: the writing must be repeated in a subsequent appeal.
Mark from 12 to 16 in the written test: the student must necessarily take the oral test.
Mark from 18 to 30L in the written test: the student can optionally take the oral test.

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.

TESTI CONSIGLIATI E BIBLIOGRAFIA/READING MATERIALS

MODULE: 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

MODULE: Information Technology applied to Radiological Sciences

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

MODULE: Data Processing and storage

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

MODULE: Basics of Physics and Physics of radiations

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