

Degree Course in Physiotherapy

INTEGRATED COURSE: PHYSICS, STATISTICS AND INFORMATION TECHNOLOGY

CFU: 8

SSD: FIS/07, INF/01, MED/01, ING-INF/05

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MODULE: PHYSICS

CFU: 2

SSD: FIS/07

PROFESSOR: Prof.ssa Alessandra Filabozzi e-mail: alessandra.filabozzi@unicamillus.org

MODULE: INFORMATION TECHNOLOGY

CFU: 2

SSD: INF/01

PROFESSOR: Prof. Andrea Dimitri e-mail: andrea.dimitri@unicamillus.org

MODULE: DATA PROCESSING SYSTEMS

CFU: 2

SSD: ING-INF/05

PROFESSOR: Prof. Andrea Dimitri e-mail: andrea.dimitri@unicamillus.org

MODULE: MEDICAL STATISTICS

CFU: 2

SSD: MED/01

PROFESSOR: Prof. Daniele Di Giovanni e-mail: daniele.digiovanni@unicamillus.org

PREREQUISITES

PHYSICS:

Knowledge and competence in Basic Mathematics, Physics and Statistics at High School level.

INFORMATION TECHNOLOGY:

No prerequisite.

MEDICAL STATISTICS

A prior knowledge of basic mathematics and a confidence in basic IT tools is required.

DATA PROCESSING SYSTEMS:

In order to get a full comprehension of the covered topics it is essential to have the knowledge obtained in the Information Technology module.

LEARNING OBJECTIVES

INFORMATION TECHNOLOGY:

The course intends to provide students with the basic knowledge to understand the essential role of Information Technology (IT) in our society, and specifically in the context of health-related technical professions.

DATA PROCESSING SYSTEMS:

The course intends to provide students with the basic knowledge to understand the role of Information Systems and their lifecycle, specifically focusing on database management systems.

MEDICAL STATISTICS

The Medical Statistics course aims at introducing students to the logic of statistical thinking and its application in everyday life. The exposition of the topics will be oriented towards concrete problems of analysis and research, starting from schematic examples and then comparing real situations taken from the medical literature.

PHYSICS:

Aim of the course of Medical Physics within the integrated course of Physics, statistics and information technology is to provide students with knowledge on the fundamentals of applied physics necessary to the performance of their future activity. In particular, the comprehension of physical principles at the base of medical physics and of functioning of medical instrumentation will be addressed.

At the end of the course, the students will know the fundamental concepts of application of the Scientific Method to the study of biomedical phenomena (choice and measure of parameters, evaluation of errors), they will be able to describe physical phenomena of complex systems using suitable mathematical tools, they will know the scientific basis of medical procedures and principles of functioning of the equipment commonly used for diagnostics and therapeutics.

LEARNING OUTCOMES

INFORMATION TECHNOLOGY:

At the end of the course the student will master the IT terminology and will get a basic knowledge of the characteristics of both modern IT systems and their main applications. Specifically, students get the elements that contribute to define the architecture of an IT system in terms of the relevant hardware and software components (applying knowledge and understanding). The topics covered in the course are applied to different case studies, so to stimulate the student decision making abilities (making judgements), as well as the communication skills and learning skills.

DATA PROCESSING SYSTEMS:

At the end of the course the student will master the Information Systems terminology and will get a basic knowledge of the characteristics of modern Information Systems and Database Management Systems. Specifically, students get the elements that contribute to define the

architecture of an Information System in terms of the relevant components (applying knowledge and understanding), with specific application to Database Management Systems. The topics covered in the course are applied to different case studies, so to stimulate the student decision making abilities (making judgements), as well as the communication skills and learning skills.

MEDICAL STATISTICS

Knowledge and understanding

At the end of this teaching the student will need to know:

- Understand and manage the statistical tools needed to describe and analyze a data table
- Describe the theoretical basis for extracting useful information from data and making informed decisions
- Know the most common contemporary software suites
- Perform differential descriptive statistics
- Perform basic inferential statistics
- Distinguish the regression methods
- Distinguish the control methods of confounding a posteriori
- Know and describe the types of longitudinal statistical study and their implementation

Applying knowledge and understanding

At the end of the course the student will be able to:

- Use the knowledge acquired for an in-depth study of aspects relating to the specific field to which the student will dedicate himself in the context of his professional activity;
- Particular emphasis will be given to statistical reasoning, interpretation and decision-making, to this end we will insist more on conceptual understanding than on mechanical calculation, also in light of the wide choice of software available for analysis

Communication skills

At the end of the course the student must know:

- Use specific scientific terminology appropriately.
- Understand the methodological statements relating to the calculation paragraphs in scientific publications

Making judgements

At the end of the course the student must know:

- .how to make general assessments of the topics covered.
- distinguish in scientific literature articles the application of statistical appropriateness described in support of the same

PHYSICS:

The specific learning outcomes of the program are coherent with the general provisions of the Bologna Process and the specific provisions of EC Directive 2005/36/EC. They lie within the European Qualifications Framework (Dublin Descriptors) as follows:

1. Knowledge and Understanding:

- Understand the experimental method and learn the use and transformation of measure units.
- Know and understand the proper terminology of physics.
- Know and understand the main physical principles and laws concerning kinetics, dynamics, electricity and magnetism, vibration and waves, radiation, balance regulating principles and fluids.
- Apply these concepts to biological and physiological phenomena in living organisms.
- Identify and recognize the physical principles which govern the function of the specific human organs.

2. Applying Knowledge and Understanding

- 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.

3. Communication Skills

- Present the topics orally in an organized and consistent manner.
- Utilize a proper scientific language coherent with the topic of discussion.

4. Making Judgements

- Recognize the importance of an in-depth knowledge of the topics consistent with a proper medical education.
- Identify the fundamental role of a proper theoretical knowledge of the topic in the clinical practice.

COURSE SYLLABUS

Syllabus INFORMATION TECHNOLOGY:

- Introduction to IT systems
- Notes on the hardware part of IT systems (CPU, memory, input/output). File system management.
- The system software: operating systems and associate utility programs
- Application software: basic tools for medical practice

Syllabus DATA PROCESSING SYSTEMS:

- *Introduction to Information Systems*
- *Standards and languages (xml, hl7, etc.)*
- *The lifecycle of Information Systems*
- *Database and Database Management System (DBMS)*

Syllabus MEDICAL STATISTICS

- *Introduction to statistics*
- *Reality observation: clinical observation and epidemiological observation*
- *Descriptive statistics and inferential statistics*
- *Quantitative and qualitative variables*
- *Absolute, relative and percentage frequency*
- *Tables, diagrams and graphs*
- *Statistical indices: measures of central tendency and dispersion*
- *Central limit theorem*
- *The normal curve (Gaussian) and its properties*
- *Statistical inference: null hypothesis and alternative hypothesis, the value of p, the statistical association*
- *Association and causality*
- *Hypothesis testing and introduction to statistical significance tests*
- *Correlation*
- *Univariate and multivariate linear regression*
- *Differences between proportions: observed and expected values and Cox regression.*

Syllabus 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*
- *Linear momentum*
- *Static equilibrium; elasticity and fracture*
- *Fluids*
- *Oscillations and waves*
- *Sound*
- *Heat*
- *Electric charge and electric field*
- *Electric potential*
- *Electric currents*
- *DC circuits*
- *Electromagnetic waves*

- The wave nature of light
- Optical instruments

COURSE STRUCTURE

The teaching is structured in 80 hours of frontal teaching on both theoretical and applicative topics, divided into lessons based on the academic calendar. Attendance is compulsory for at least 75% of the hours, added to all the courses of the integrated course.

COURSE GRADE DETERMINATION

INFORMATION TECHNOLOGY:

Learning outcomes will be assessed by use of tests delivered at class time, as well as by use of the final exam. The overall evaluation will address all the topics covered during the course. The final exam will be carried as a computer-based written text consisting of a number of multiple-choice questions.

PHYSICS

PHYSICS ASSESSMENT TEST: 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.

DATA PROCESSING SYSTEMS:

The achievement of the expected learning outcomes will be verified through tests carried out during lectures and through the final exam. All the subjects covered during the course will be assessed. The final exam will consist in a written multiple-choice question test, in classroom or in computer room.

MEDICAL STATISTICS

The assessment of the achievement of the objectives set in the module consists of a written and an oral test on topics covered in the course. All the contents of the course are assessed.

The written test will include the resolution of one or more problems and multiple-choice questions, in order to verify the achievement of the objective of the ability to apply the acquired knowledge.

Students who have obtained a sufficient mark ($>18/30$) in the written test will be admitted to the oral test.

OPTIONAL ACTIVITIES

MEDICAL STATISTICS

If necessary, the students can have an appointment for solving doubts or deepen topics on the teaching program.

READING MATERIALS

INFORMATION TECHNOLOGY:

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

DATA PROCESSING SYSTEMS:

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

STATISTICA MEDICA/ MEDICAL STATISTICS

1) Notes of the lessons

2) Harvey Motulsky. *Biostatistica Essenziale. Una guida non matematica. Edizione italiana a cura di Leonardo Emberti Gialloreti. Editore Piccin, Padova, 2021.*

FISICA / PHYSICS

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