Degree Course in Physioterapy

INTEGRATED COURSE: PHYSICS, STATISTICS AND INFORMATION TECHNOLOGY
CREDITS: 8
SSD: FIS/07, INF/01, MED/01, ING-INF/05
DOCENTE RESPONSABILE: Prof. Andrea Dimitri e-mail: andrea.dimitri@unicamillus.org

MODULO: PHYSICS
NUMERO DI CFU: 2
SSD: FIS/07
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MODULO: INFORMATION TECHNOLOGY
NUMERO DI CFU: 2
SSD: INF/01
DOCENTE: Prof. Andrea Dimitri e-mail: andrea.dimitri@unicamillus.org

MODULO: DATA PROCESSING SYSTEMS
NUMERO DI CFU: 2
SSD: ING-INF/05
DOCENTE: Prof. Andrea Dimitri e-mail: andrea.dimitri@unicamillus.org

MODULO: MEDICAL STATISTICS
NUMERO DI CFU: 2
SSD: MED/01
DOCENTE: Prof. Luca Weltert e-mail: luca.weltert@unicamillus.org

PREREQUISITES

PHYSICS:
Knowledge and competence in Basic Mathematichs, 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 to introduce 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 confronting 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 in person*
- *Perform low grade inferential statistics in person*
- *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:

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

The first part of the course will introduce the logic of statistics and experimental design.The concepts of probability calculation and combinatorial calculation will be introduced or recalled; although theoretically already in possession of the student, these steps are fundamental and will be used in the continuation of the course. In this phase the main probability distributions will be treated, including the binomial distribution, the Poisson distribution and the standard Normal and Normal distributions, but more than the single mathematical process,we will try making the student aware of the deep motivation of the medical statistics, as a science, and its application in practice, as well as the risks of its incorrect understanding.In the second part of the course the descriptive statistics and its methodology will be addressed. It will be shown how to recognize the type of data and how to summarize them in appropriate indexes.The student will learn how to calculate position measurements (mean, median, fashion), variability (variance, standard deviation), coefficient of variation (CV), percentiles and their use. It will also make extensive use of practical examples to define a good descriptive statistic and a defective or deceptive descriptive statistic. In the final part of the course the general principles of statistical inference will be treated. Cases of sample distribution, type I and II errors, power of a test and operating curve will be introduced. We will then move on to parametric tests - Student's t-test, ANOVA with 1 and 2 classification criteria, non-parametric tests: - Wilcoxon test, Mann-Whitney test, Kruskal-Wallis test, Friedman test, median test, chi-square test, Fisher exact test. We will also provide the basic concepts of regression and analysis of time dependent variability with mention of Kaplann Meyer functions, log rank 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:

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.

MEDICAL STATISTICS

The assessment of the achievement of the objectives set out in the module provides a written test, consisting mainly of open-ended questions on topics covered in the course. In this way, it will be ascertained the student's knowledge and understanding of both the theoretical principles and their consequences in the medical and biological fields.

The written test will also include the resolution of one or more problems, to verify the achievement of the objective of the ability to apply the acquired knowledge to a simulated situation of biological or medical interest..

The evaluation of the works will attribute the same weight to the answers to the open questions and to the proposed problems. In the process of delivering the papers and transcribing the vote, the student will be given the opportunity to further externalize his / her knowledge and supplement the written test.

OPTIONAL ACTIVITIES

MEDICAL STATISTICS

Practical complementary teaching activities, with seminars and working exercises on statistical software will be communicated and planned during the course.

PHYSICS

In addition to the teaching activity, the student will be given the opportunity to participate in seminars, research internships, department internships and monographic courses. The topics of the activities are not subject to examination. Acquisition of the hours allocated occurs only with a mandatory frequency of 100%.

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

MEDICAL STATISTICS

1) Notes of the lessons
2) Stanton A. Glantz: Statistics for Bio-medical disciplines - ed. McGraw-Hill
3) Sidney Siegel, N. John Castellan Jr.: - Non parametric statistics - ed. McGraw-Hill
4) Resources and links from the Internet with particular reference to the use of the PubMEd portal

PHYSICS

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