



SCIENZE PROPEDEUTICHE

6 CFU - 1° Semester

Teaching Staff

ELENA BRUNO - Module Physics - FIS/07 - 2 CFU

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ALFREDO PULVIRENTI - Module INFORMATICA - INF/01 - 2 CFU

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ALFREDO PULVIRENTI - Module STATISTICA MEDICA - MED/01 - 2 CFU

LEARNING OBJECTIVES

▪ Physics

The course has the declared objective of providing adequate knowledge and understanding of the fundamental physical laws that are used in the various methods of image diagnostics, as well as the skills in the application of knowledge and the ability to understand the basic scientific language

▪ INFORMATICA

Objective of the course is the acquisition of methods for the analysis of biological sequences and structures and the capability of searching in biological databases (eg. Genes, sequences, functional domains). Starting from primary sequences of nucleic acids or proteins can hypothesize the function, evolutionary history and structure. The tools used to achieve these objectives are the public databases and the tools for the analysis and visualization of such kind of data.

Knowledge and understanding: Students will gain knowledge on methods for the analysis of biological sequences and for searching in biological databases. In particular students will be able to search on database of sequences and domains. Also, public databases available on NCBI will be presented together with software for the analysis and visualization of biological data. Finally, students will acquire the basic tools for the analysis of the transcriptome.

Applying knowledge and understanding: identify the appropriate tools to manipulate data and extract knowledge underlying; solve problems through the use of appropriate software in bioinformatics.

Making judgments: Through guided exercises, the students will acquire the basic skills necessary to deal with the analysis of new biological sequences, hypothesizing the function, study the transcriptome.

Communication skills: the student will acquire the necessary communication skills and expressive appropriateness in the use of technical language within the general framework of the analysis of biological data.

Learning skills: The course aims, as the goal, to provide students with the necessary basic theoretical methods and practices in order to address and solve problems concerning the analysis of biological data.

▪ **STATISTICA MEDICA**

General summary:

The course aims to acquire the main basic concepts of probability and statistics.

General teaching training objectives in terms of learning outcomes:

Knowledge and understanding: The course aims to acquire skills to students about the description of statistical data; Understand the basic terms (population, sample, variable, etc.); Calculation and presentation of frequency distributions; data description with graphical methods; Calculation of central tendency and variability indices; Understand the basis of the assessment of probability of an event and of a random variable; Acquiring concepts related to inferential statistics such as estimates for interval confidence and hypothesis tests.

Applying knowledge and understanding: identify distributions appropriate to represent the knowledge underlying; solving problems of inferential statistics and probability.

Making judgments : Through concrete examples and case studies, the student will be able to independently develop solutions to specific problems and assess the suitability of a statistical inference problem and solution.

Communication skills: the student will acquire the necessary communication skills and expressive appropriateness in the use of technical language within the general framework of the analysis of data using statistical methods.

Learning skills: The course aims, as the goal, to provide students with the necessary theoretical and practical methods to address and solve problems independently in the statistical analysis of data.

COURSE STRUCTURE

▪ **Physics**

Frontal lessons

▪ **INFORMATICA**

Frontal Lectures

▪ **STATISTICA MEDICA**

Frontal Lectures

DETAILED COURSE CONTENT

▪ **Physics**

1. Introduction and basic introductory notions: algebraic calculation, percentage, trigonometry, logarithms, volume and surface. Units of measurement and dimensional equations. Quantifying a size. Significant figures. Graphical representation of functions. 2. The concept of error. Unit of measurement of the International System (SI): time, mass, length. The prefixes. Derived units. Dimensional equations. Scalar and vector quantities. Operations with vectors 3. The concept of force. Composition of forces. Effects on translatory and rotatory motion - Equations of motion. Newton's laws. Balance conditions. Work, energy and power 4. Electrical phenomena, electric charges, Coulomb's law, structure of the atom, methods of charging, electric field, Gauss theorem, electric potential, electric dipole, capacitors, electric current, conductors and insulators, resistance electric, Ohm's law, electromotive force and direct current circuits, thermal effect of the current. Kirchoff's laws. 5. Magnetic materials, sources of magnetic fields, effect of a magnetic field on moving charges, Lorentz force, magnetic fields produced by currents, Ampere theorem, electromagnetic induction, Self-induction coefficient, R-L circuit. Charge and discharge of a capacitor. R-C circuit 6. Wave phenomena, mechanical and electromagnetic waves, magnitudes characteristic of a wave, Doppler effect, interference, diffraction, refraction, wave reflection. Electromagnetic spectrum

▪ **INFORMATICA**

Introducion to relational Databases: • Data representation; • The Relational model; • Relational Algebra; • Database Design; • Access: Tables, queries, report, forms; • Examples and case studies. Biological and biomedical databases: - NCBI: The Entrez system. Methods for querying databases Gene, Nucleotide, Protein, PubMed, OMIM. - Special purpors databases: Protein Data Bank (PDB), Single Nucleotide Polymorphism DB (SNP), Gene Expression Omnibus (GEO), Genome, UCSC, ENSEMBL, Gene Ontologies DB, BioSystem Pathways, KEGG Patways, Patways Commons, Tarbase, Mirò, mirBase, Expressed Sequence Tag (EST). Locked

▪ **STATISTICA MEDICA**

Introduction to probability and statistics: • Introduction to probability; • Events; • Definition of probability; • Conditioned events; • Bayes Theorem; • Discrete Random Variables; • Expectation, Variance, Covariance, Standard Deviation; • Bernoulli distribution; Binomial Distribution; Hypergeometric Distirbution; Negative Bionomial Distribution; Geometric Distribution; Poisson Distribution; • Continuos Random Variables; • Uniform distribution; Exponoential Distribution; Gaussian Distribution; • Examples and excercices; • Introduction to Descriptive Statitiscs; • The data, variables, variability, indeces; • Statistical Inference: parameter estimation, statistical tests; • • Examples and excercices; • Introduction to R.

TEXTBOOK INFORMATION

▪ **Physics**

D. Scannicchio, E. Giroletti "Elementi di Fisica Biomedica" Ed. EdiSES

F. Borsa, A. Lascialfari "Principi di Fisica per indirizzo biomedico e farmaceutico" Ed. EdiSES

G. M. Contessa, G A. Marzo "Fisica applicata alle scienze mediche" Ed. CEA

A. Giambattista, B. Richardson, R. Richardson "Fisica generale" Ed. Graw Hill

▪ **INFORMATICA**

- Anna Tramontano "Bioinformatica", Zanichelli
- Krane, Raymer. "Fondamenti di Bioinformatica" Pearson
- Jambeck, Gibas "Developing Bioinformatics Computer Skills, O'Reilly
- Pascarella-Paiardini "Bioinformatica" Zanichelli

▪ **STATISTICA MEDICA**

Lantieri PB, Riso D, Ravera G: Statistica medica per le professioni sanitarie, II ed. McGraw-Hill
