UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

PHYSICS, STATISTICS AND COMPUTER SCIENCE

Enrollment year	2021/2022
Academic year	2021/2022
Regulations	DM270
Department	DEPARTMENT OF CLINICAL-SURGICAL, DIAGNOSTIC AND PEDIATRIC SCIENCES
Course	CARDIOCIRCULATORY AND CARDIOVASCULAR PERFUSION TECHNIQUES
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	1st semester (04/10/2021 - 21/01/2022)
ECTS	8
Language	ITALIAN. Topics below divided in 4 parts: 1) GENERAL INFORMATICS 2) APPLIED PHYSICS 3) BIOMETRICS AND MEDICAL STATISTICS 4) STATISTICS FOR THE EXPERIMENTAL AND TECHNOLOGICAL RESEARCH
Prerequisites	1) = 2) Topics already learned at the high school such as: the concept of equation and the basic rules for its solution, the representation of digits in the scientific notation as power of ten with positive and negative exponent; logarithms and their properties; the definition of function; the cartesian representation of a graph of a straight line, a parabola, a hyperbola and an exponential function; the trigonometric functions; the measure of the angle in radiants; the surface areas and volumes of some geometrical figures (triangle, rectangle, circle, cube, sphere) 3) The course is part of the students' basic training together with Physics, preparatory to the lessons and activities in the haelthcare field. To better follow the course, the student must have basic knowledge of mathematics of scientific high schools' program. It is mandatory for Statistics for research and technology course. 4) The course is part of the basic training of students: together with Physics, Medical Statistics and Computer Science, it is a prerequisite for lessons and activities in the healthcare field. To better follow the course, the student must have attended and acquired basic skills in

Medical Statistics and Biometrics.

Learning outcomes

1) The course is aimed at realization of the main methods of statistical analysis using a common program such as Microsoft Excel (2010 version).
At the end of the course the student will have learned the elements for: Learn how to build a data matrix; Build graphical representations; Analyze the data both from descriptive point of view that analytical; The interpretation of the results.
2) The aims of the course are:
a) to instill in the student the fundamental topics of Physics for the comprehension of biological and biomedical phenomena
b) to impart the meaning of scientific method
c) to teach the student how to apply the principles and law of Physics to specific problems, in particular the biological and biomedical ones
At the end of the course the students must be able to:
a) find the fundamental physical quantities which are involved in the description of a physical phenomenon
b) schematize the physical phenomenon with a model which could represent the fundamental characteristics of the system under study
c) formulate physical laws of the system under study, if they derive from general principles or they are of empirical origins, and represent them in an analytical or graphical form
d) analyze from a quantitative point of view the inter-dependence among two or more physical quantities
e) integrate all the knowledge acquired for the resolution of a specific problem
3) The course of Medical statistics and Biometry aims to provide the methodological principles for a scientific approach to the study in healthcare field. It is the first step in the knowledge that an operator in the healthcare field must have in order that the scientific research carried out is correctly set and evaluated.
In detail, the course aims to develop the theoretical and practical knowledge of the most frequent descriptive statistical methodologies (knowledge and comprehension), as well as the ability to correctly apply this knowledge both to new experimental situations and to published research studies (ability to apply knowledge and comprehension).
At the end of the course the student will be able to independently perform basic statistical analyses and communicate in an appropriate way the findings, as well as to understand and critically evaluate the published evidences in relation to their work context.
4) The course gives tools for bivariate analysis and interpretation of data in healthcare area.
In detail, the course aims to develop the theoretical and practical knowledge of the most frequent inferential statistical methodologies (knowledge and comprehension), as well as the ability to correctly apply this knowledge both to new experimental situations and to published research studies (ability to apply knowledge and comprehension).
At the end of the course the student will be able to independently perform basic statistical analyses and communicate in an appropriate way the findings, as well as to understand and critically evaluate the published evidences in relation to their work context.

Course contents

1) Definition of electronic spreadsheet; Programme and toolbar structure;
Creation a data matrix; Introduction to the functions for the main descriptive statistics: Count cells: CONTA (); Sum: SOMMA (); Minimum: MIN (); Maximum: MAX (); Mean: MEDIA (); Mode: MODA (); Median: MEDIANA (); SD: DEV.ST (); Variance: VAR (); Range: MAX () - MIN (); Coefficient of variation: DEV.ST () / MEDIA (); Using the command Data Analysis for the analysis of descriptive statistics; Pivot tables in single and double entry, creation of classes for quantitative variables with data display: Normal; Percentage of the total; Average; Standard deviation; Pivot Charts for qualitative variables (bars and aerogramma) and quantitative (histogram) with an explanation of the design and the layout (title, axes, legend, data labels); Application of the correlation Pearson's test through the Data Analysis command and creation of scatter plot.
2) Preliminary concepts: physical quantities and their dimensions. System of units, scalar and vectors.
Kinematics: trajectory and equation of motion, velocity and acceleration. Main motions and their equations.
Dinamics: forces, Newton Laws of the dynamics, momentum conservation, mass, weight force, density. Work, energy and power; kinetic energy and kinetic energy theorem; conservative forces and potential energy, principle of conservation of mechanical energy. Friction forces.
Fluids statics: concept of pressure, Pascal’s law, hydrostatic pressure, Stevin law and its consequences, principle of operation of sphygmomanometer, Archimedes' principle, atmospheric pressure, transfusion and blood sample procedure.
Fluids dynamics: properties of ideal fluids, flow rate, stationary motion, continuity equation also related to circulatory system, Bernoulli theorem. Real fluids: viscosity, measurement of blood pressure.
Thermodynamics: temperature and thermometric scales, absolute temperature, heat and internal energy, heat and temperature, specific heat and heat capacity concepts, mechanical equivalent of heat, mechanisms of heat release, ideal gas laws, Avogadro law, real gases, thermodynamic processes, laws of thermodynamics.
Electrostatics and electrodynamics: electric charges and Coulomb’s law, electrostatic field, electrostatic potential energy, electric potential, voltage. Ohmic conductors and Ohm’s laws; power dispersed in a conductor, electrolytic conductors.
Waves: mechanical and electromagnetic waves, transverse and longitudinal waves, concepts of period and frequency, wave function, wave parameters, wave intensity. Sound and its properties.
Radiations: electromagnetic spectrum, thermic radiations and their intensity. Classification of electromagnetic waves, ionizing radiations and their biological effects, X-rays absorption and radiotherapy.
3) Introduction to Statistic and research planning.
Variability and chance.
Planning of a research. Research Protocol.
- Population, sample and sampling methods (non-probabilistic and probabilistic);
- Experimental and Observational studies design
- Data organization: database and dataset.

	Tools for descriptive analysis and interpretation of data - Description of statistical unit and type of variables. Frequency distribution for qualitative and quantitative variables. Graphics. - Descriptive statistics: mean, median, mode, centiles, range variance, standard deviation, coefficient of variation. - Normal distribution. 4) Inferential statistics - Test of hypothesis, type error I and II, p-value. - General t-test. - Parametric unpaired and paired t-test. - Test on correlation coefficient. - Chi-squared test. - Statistical and clinical significance.
Teaching methods	1) The course is based on taught lessons and practical applications through pc with resolution of statistical problem using excel In particular students will have to attend taught lessons at one of the computerized classroom of the University. 2) Front side lectures 3) The course is organised in lectures and practical exercises. With the problem solving approach, the fundamental elements of Medical Statistics will be addressed. Practical exercises aim to the interpretation and comprehension of evidences deriving from the right application of methods medical statistics. 4) The plan of the course is based on academic lectures and practical section (problem solving approach). The course is organized in lectures and practical exercises. With the problem solving approach, learners will be introduced to the correct application of inferential analysis procedures and interpretation of results. Practical exercises are not aimed at the application of theoretical concepts on experimental data sets, but at the interpretation / comprehension of scientific evidence deriving from the correct application of inferential statistics techniques.
Reccomended or required readings	1) 1) The course is based on taught lessons and practical applications through pc with resolution of statistical problem using excel In particular students will have to attend taught lessons at one of the computerized classroom of the University. Excel & Statistica Medica di S.Villani e P.Borrelli, Ed. MEDEA 2013 2) * F. Borsa, A. Lascialfari, “Principi di Fisica”, ed. Edises * F. Borsa, G. L. Introzzi, D. Scannicchio, ELEMENTI DI FISICA per diplomi di indirizzo medico biologico. Edizioni UNICOPLI, Milano. * F. Borsa, S. Altieri, LEZIONI DI FISICA CON LABORATORIO. Edizioni La Goliardica, Pavia * files of the slides of the lectures, provided by the lecturer 3) - Lantieri P, Risso D, Ravera G. Statistica medica per le professioni sanitarie. McGraw-Hill. - Triola, Triola. Fondamenti di Statistica per le discipline biomediche. Pearson, 2017

- MC Whitlock, D Schluter. ANALISI STATISTICA DEI DATI BIOLOGICI. Zanichelli.
- Swinscow & Campbell. Le basi della Statistica per le Scienze bio-mediche. X Edizione. Minerva Medica.
4) - Lantieri P, Risso D, Ravera G. Statistica medica per le professioni sanitarie. McGraw-Hill.
- Triola, Triola. Fondamenti di Statistica per le discipline biomediche. Pearson, 2017
- MC Whitlock, D Schluter. ANALISI STATISTICA DEI DATI BIOLOGICI. Zanichelli.
- Swinscow & Campbell. Le basi della Statistica per le Scienze bio-mediche. X Edizione. Minerva Medica.
Any other Biostatistics or Medical Statistics manual may be used.
Useful material will be on Kiro platform.

Assessment methods

1) Examination will carry out using pc: analysis of a data set and resolving the statistical problems
2) Written test of questions with multiple answer and/or exercises and/or open-text questions.
Oral only on request to increase the score.
3) The examination will be written with a problem solving approach and integrated with Statistics for research and technology. The student must demonstrate not only to know and correctly apply the techniques of analysis (knowledge and skills), but to be able to interpret the results obtained and communicate in a scientifically correct way the evidences form the analyses (competence). Three closed questions on theory aspects are also provided.
4) The examination will be written with a problem solving approach and integrated with Medical statistics and biometry. The student must demonstrate not only to know and correctly apply the techniques of analysis (knowledge and skills), but to be able to interpret the results obtained and communicate in a scientifically correct way the evidences form the analyses (competence). Three closed questions on theory aspects are also provided.

Further information

1)
To contact the teacher using mail:
anna.verri@unipv.it
2) * email docente:
alessandro.lascialfari@unipv.it
* tel. docente : 0382 987499
* ricevimento studenti : appuntamento da concordare via email col docente
* sito web slides lezioni :
https://sites.unimi.it/lascialfari/didactics.htm
3) The Professor takes appointments (Dept. of Public Health, Experimental and Forensic Medicine, U.O. of Biostatistics and Clinical Epidemiology, Via Forlanini 2, e-mail: paola.borrelli@unipv.it).
4) The Professor takes appointments (Dept. of Public Health, Experimental and Forensic Medicine, U.O. of Biostatistics and Clinical Epidemiology, Via Forlanini 2, e-mail: svillani@unipv.it), usually on Tuesday.

The activity is split

500396 - **PHYSICS**

503391 - **BASIC COMPUTER SCIENCE**

503392 - **MEDICAL STATISTICS AND BIOMETRY**

503393 - **STATISTICS FOR RESEARCH AND TECHNOLOGY**

UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

PHYSICS	
Enrollment year	2021/2022
Academic year	2021/2022
Regulations	DM270
Academic discipline	FIS/07 (APPLIED PHYSICS (CULTURAL HERITAGE, ENVIRONMENT, BIOLOGY AND MEDICINE))
Department	DEPARTMENT OF CLINICAL-SURGICAL, DIAGNOSTIC AND PEDIATRIC SCIENCES
Course	CARDIOCIRCULATORY AND CARDIOVASCULAR PERFUSION TECHNIQUES
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	(04/10/2021 - 21/01/2022)
ECTS	3
Lesson hours	24 lesson hours
Language	Italian
Activity type	WRITTEN TEST
Teacher	BORTOLUSSI SILVA (titolare) - 3 ECTS
Prerequisites	Topics already learned at the high school such as: the concept of equation and the basic rules for its solution, the representation of digits in the scientific notation as power of ten with positive and negative exponent; logarithms and their properties; the definition of function; the cartesian representation of a graph of a straight line, a parabola, a hyperbola and an exponential function; the trigonometric functions; the measure of the angle in radiants; the surface areas and volumes of some geometrical figures (triangle, rectangle, circle, cube, sphere)
Learning outcomes	The aims of the course are: a) to instill in the student the fundamental topics of Physics for the comprehension of biological and biomedical phenomena b) to impart the meaning of scientific method

	c) to teach the student how to apply the principles and law of Physics to specific problems, in particular the biological and biomedical ones At the end of the course the students must be able to: a) find the fundamental physical quantities which are involved in the description of a physical phenomenon b) schematize the physical phenomenon with a model which could represent the fundamental characteristics of the system under study c) formulate physical laws of the system under study, if they derive from general principles or they are of empirical origins, and represent them in an analytical or graphical form d) analyze from a quantitative point of view the inter-dependence among two or more physical quantities e) integrate all the knowledge acquired for the resolution of a specific problem
Course contents	Preliminary concepts: physical quantities and their dimensions. System of units, scalar and vectors. Kinematics: trajectory and equation of motion, velocity and acceleration. Main motions and their equations. Dinamics: forces, Newton Laws of the dynamics, momentum conservation, mass, weight force, density. Work, energy and power; kinetic energy and kinetic energy theorem; conservative forces and potential energy, principle of conservation of mechanical energy. Friction forces. Fluids statics: concept of pressure, Pascal's law, hydrostatic pressure, Stevin law and its consequences, principle of operation of sphygmomanometer, Archimedes' principle, atmospheric pressure, transfusion and blood sample procedure. Fluids dynamics: properties of ideal fluids, flow rate, stationary motion, continuity equation also related to circulatory system, Bernoulli theorem. Real fluids: viscosity, measurement of blood pressure. Thermodynamics: temperature and thermometric scales, absolute temperature, heat and internal energy, heat and temperature, specific heat and heat capacity concepts, mechanical equivalent of heat, mechanisms of heat release, ideal gas laws, Avogadro law, real gases, thermodynamic processes, laws of thermodynamics. Electrostatics and electrodynamics: electric charges and Coulomb's law, electrostatic field, electrostatic potential energy, electric potential, voltage. Ohmic conductors and Ohm's laws; power dispersed in a conductor, electrolytic conductors. Waves: mechanical and electromagnetic waves, transverse and longitudinal waves, concepts of period and frequency, wave function, wave parameters, wave intensity. Sound and its properties. Radiations: electromagnetic spectrum, thermic radiations and their intensity. Classification of electromagnetic waves, ionizing radiations and their biological effects, X-rays absorption and radiotherapy.
Teaching methods	Front side lectures
Reccomended or required readings	* F. Borsa, A. Lascialfari, "Principi di Fisica", ed. Edises * F. Borsa, G. L. Introzzi, D. Scannicchio, ELEMENTI DI FISICA per diplomi di indirizzo medico biologico. Edizioni UNICOPLI, Milano.

	* F. Borsa, S. Altieri, LEZIONI DI FISICA CON LABORATORIO. Edizioni La Goliardica, Pavia * Files delle slides proiettate a lezione
Assessment methods	Written test of questions with multiple answer and/or exercises and/or open-text questions. Oral only on request to increase the score.
Further information	* email docente: alessandro.lascialfari@unipv.it * tel. docente : 0382 987499 * ricevimento studenti : appuntamento da concordare via email col docente * sito web slides lezioni : https://sites.unimi.it/lascialfari/didactics.htm
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile

UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

BASIC COMPUTER SCIENCE

Enrollment year	2021/2022
Academic year	2021/2022
Regulations	DM270
Academic discipline	INF/01 (COMPUTER SCIENCE)
Department	DEPARTMENT OF CLINICAL-SURGICAL, DIAGNOSTIC AND PEDIATRIC SCIENCES
Course	CARDIOCIRCULATORY AND CARDIOVASCULAR PERFUSION TECHNIQUES
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	(04/10/2021 - 21/01/2022)
ECTS	1
Lesson hours	8 lesson hours
Language	Italian
Activity type	WRITTEN TEST
Teacher	DAGLIATI ARIANNA - 1 ECTS
Prerequisites	=
Learning outcomes	The course is aimed at realization of the main methods of statistical analysis using a common program such as Microsoft Excel (2010 version). At the end of the course the student will have learned the elements for: Learn how to build a data matrix; Build graphical representations; Analyze the data both from descriptive point of view that analytical; The interpretation of the results.
Course contents	Definition of electronic spreadsheet; Programme and toolbar structure; Creation a data matrix; Introduction to the functions for the main descriptive statistics: Count cells: CONTA (); Sum: SOMMA (); Minimum: MIN (); Maximum: MAX (); Mean: MEDIA (); Mode: MODA (); Median:

	MEDIANA (); SD: DEV.ST (); Variance: VAR (); Range: MAX () - MIN (); Coefficient of variation: DEV.ST () / MEDIA (); Using the command Data Analysis for the analysis of descriptive statistics; Pivot tables in single and double entry, creation of classes for quantitative variables with data display: Normal; Percentage of the total; Average; Standard deviation; Pivot Charts for qualitative variables (bars and aerogramma) and quantitative (histogram) with an explanation of the design and the layout (title, axes, legend, data labels); Application of the correlation Pearson's test through the Data Analysis command and creation of scatter plot.
Teaching methods	The course is based on taught lessons and practical applications through pc with resolution of statistical problem using excel In particular students will have to attend taught lessons at one of the computerized classroom of the University.
Reccomended or required readings	Excel & Statistica Medica di S.Villani e P.Borrelli, Ed. MEDEA 2013
Assessment methods	Examination will carry out using pc: analysis of a data set and resolving the statistical problems
Further information	To contact the teacher using mail: anna.verri@unipv.it
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile

UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

MEDICAL STATISTICS AND BIOMETRY

Enrollment year	2021/2022
Academic year	2021/2022
Regulations	DM270
Academic discipline	MED/01 (MEDICAL STATISTICS)
Department	DEPARTMENT OF CLINICAL-SURGICAL, DIAGNOSTIC AND PEDIATRIC SCIENCES
Course	CARDIOCIRCULATORY AND CARDIOVASCULAR PERFUSION TECHNIQUES
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	(04/10/2021 - 21/01/2022)
ECTS	2
Lesson hours	16 lesson hours
Language	Italian
Activity type	WRITTEN TEST
Teacher	FERRARO OTTAVIA ELEONORA - 2 ECTS
Prerequisites	The course is part of the students' basic training together with Physics, preparatory to the lessons and activities in the haelthcare field. To better follow the course, the student must have basic knowledge of mathematics of scientific high schools' program. It is mandatory for Statistics for research and technology course.
Learning outcomes	The course of Medical Statistics and Biometry aims to provide the methodological principles for a scientific approach to the study in the healthcare field. It is the first step in the knowledge that an operator in the healthcare field must have in order to carry out correct results with comments. In detail, the course aims to develop the theoretical and practical knowledge of the most frequent descriptive statistical methodologies (knowledge and comprehension), as well as the ability to correctly apply

	this knowledge in the healthcare field. At the end of the course, the student will be able to independently perform basic statistical analyses and communicate in an appropriate way the findings, as well as to understand and critically evaluate results.
Course contents	Introduction to Statistic and research planning. Planning of a research - Population, sample, and sampling methods (non-probabilistic and probabilistic); - Experimental and Observational studies design - Data organization: database and dataset. Tools for descriptive analysis and interpretation of data - Description of statistical unit and type of variables. Frequency distribution for qualitative and quantitative variables. Graphics. - Descriptive statistics: mean, median, mode, range variance, standard deviation, coefficient of variation.
Teaching methods	The course is organised in lectures and practical exercises. With the problem solving approach, the fundamental elements of Medical Statistics will be addressed. Practical exercises aim to the interpretation and comprehension of evidences deriving from the right application of methods medical statistics.
Reccomended or required readings	- MC Whitlock, D Schluter. Analisi statistica dei dati biologici. Zanichelli - Newbold P,Carlson W, Throne B. Statistica. Pearson - Lantieri P, Risso D, Ravera G. Statistica medica per le professioni sanitarie. McGraw-Hill
Assessment methods	The examination will be written with a problem solving approach and question about theory of statistics.
Further information	The Professor takes appointments (Dept. of Public Health, Experimental and Forensic Medicine, U.O. of Biostatistics and Clinical Epidemiology, Via Forlanini 2, e-mail: ottavia.ferraro@unipv.it).
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile

UNIVERSITÀ DI PAVIA

Anno Accademico 2021/2022

STATISTICS FOR RESEARCH AND TECHNOLOGY

Enrollment year	2021/2022
Academic year	2021/2022
Regulations	DM270
Academic discipline	SECS-S/02 (STATISTICS FOR EXPERIMENTAL AND TECHNOLOGICAL RESEARCH)
Department	DEPARTMENT OF CLINICAL-SURGICAL, DIAGNOSTIC AND PEDIATRIC SCIENCES
Course	CARDIOCIRCULATORY AND CARDIOVASCULAR PERFUSION TECHNIQUES
Curriculum	PERCORSO COMUNE
Year of study	1°
Period	(04/10/2021 - 21/01/2022)
ECTS	2
Lesson hours	16 lesson hours
Language	Italian
Activity type	WRITTEN TEST
Teacher	GENTILINI DAVIDE - 2 ECTS
Prerequisites	The course is part of the basic training of students: together with Physics, Medical Statistics and Computer Science, it is a prerequisite for lessons and activities in the healthcare field. To better follow the course, the student must have attended and acquired basic skills in Medical Statistics and Biometrics.
Learning outcomes	The course gives tools for bivariate analysis and interpretation of data in healthcare area. In detail, the course aims to develop the theoretical and practical knowledge of the most frequent inferential statistical methodologies (knowledge and comprehension), as well as the ability to correctly apply this knowledge both to new experimental situations and to published research studies (ability to apply knowledge and comprehension).

	At the end of the course the student will be able to independently perform basic statistical analyses and communicate in an appropriate way the findings, as well as to understand and critically evaluate the published evidences in relation to their work context.
Course contents	Inferential statistics - Test of hypothesis, type error I and II, p-value. - General t-test. - Parametric unpaired and paired t-test. - Test on correlation coefficient. - Chi-squared test. - Statistical and clinical significance.
Teaching methods	The plan of the course is based on academic lectures and practical section (problem solving approach). The course is organized in lectures and practical exercises. With the problem solving approach, learners will be introduced to the correct application of inferential analysis procedures and interpretation of results. Practical exercises are not aimed at the application of theoretical concepts on experimental data sets, but at the interpretation / comprehension of scientific evidence deriving from the correct application of inferential statistics techniques.
Reccomended or required readings	- Lantieri P, Risso D, Ravera G. Statistica medica per le professioni sanitarie. McGraw-Hill. - Triola, Triola. Fondamenti di Statistica per le discipline biomediche. Pearson, 2017 - MC Whitlock, D Schluter. ANALISI STATISTICA DEI DATI BIOLOGICI. Zanichelli. - Swinscow & Campbell. Le basi della Statistica per le Scienze bio-mediche. X Edizione. Minerva Medica. Any other Biostatistics or Medical Statistics manual may be used. Useful material will be on Kiro platform.
Assessment methods	The examination will be written with a problem solving approach and integrated with Medical statistics and biometry. The student must demonstrate not only to know and correctly apply the techniques of analysis (knowledge and skills), but to be able to interpret the results obtained and communicate in a scientifically correct way the evidences form the analyses (competence). Three closed questions on theory aspects are also provided.
Further information	The Professor takes appointments (Dept. of Public Health, Experimental and Forensic Medicine, U.O. of Biostatistics and Clinical Epidemiology, Via Forlanini 2, e-mail: svillani@unipv.it), usually on Tuesday.
Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile