COURSE DATA

DATA SUBJECT

Code: 35075
Name: Criminal Analysis Techniques
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1302 - Degree in Criminology	Facultat de Dret	2	Second quarter
1923 - Double Degree Programme Law-Criminology	Facultat de Dret	2	Second quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1302 - Degree in Criminology	Forensic techniques	COMPULSORY
1923 - Double Degree Programme Law-Criminology	Year 2 compulsory subjects	COMPULSORY

COORDINATION

GARCIA PEREZ MIGUEL ANGEL

SUMMARY

The course "Techniques of criminal analysis" aims to bring the criminology professional closer to the laboratory where, on many occasions, analyses are carried out, whether chemical-toxicological or with biological materials, which help to clarify and sometimes confirm the facts of a crime.

Understanding not only the language but also the scientific basis of the different techniques used in the laboratory is one of the priorities of the subject, and one of the objectives is that the student is able to know the applications they have in criminology.

The progress of physicochemical, genetic, biochemical and molecular biology techniques in the last 60 years, as well as the knowledge of the human genome have allowed, with the application and adaptation to the peculiarities of the samples collected at the crime scene, that all this technology has been put at the service of laboratories where the scientific police work with means that allow them to obtain information from biological materials (hair, semen, saliva, blood ...) or chemicals (drugs, explosives, poisons, narcotics ...).

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

There are no specified enrollment restrictions with other subjects of the curriculum.

OTHER REQUIREMENTS

Not required

COMPETENCES / LEARNING OUTCOMES

1302 - Degree in Criminology

Conocer con propiedad los conceptos empleados en los laboratorios forenses y en los informes periciales. G:1 y E:4, 11, 12 ,14

Saber discernir la adecuación de solicitar determinadas pruebas forenses. G:1,9 y E: 4, 12,22

DESCRIPTION OF CONTENTS

1. DNA sources in forensic applications. Collection and processing of biological samples

DNA types and forensic applications
Sample collection and processing
DNA manipulation in the laboratory
DNA databases

2. Genetics and basic laws of inheritance

Basic laws of inheritance: Mendel and his peas.
Calculation of the probability of transmitting a character
Definition of gene
But... Where are the genes?

3. DNA, the molecule that carries the hereditary material. Genetic information flow

Why DNA? What does DNA offer us? Daubert standard
DNA, the molecule that carries hereditary material.
Alleles vs. genotype/phenotype
DNA replication

How are genes transmitted?
Central dogma of molecular biology (one gene, one protein)
Transcription and Translation
Variability in proteins

4. Genetic variability in populations and detection techniques

Where to find genetic variability?
Types of DNA markers
Inheritance of genetic markers
Lineage markers
Detection techniques

5. Pedigrees and genetic fingerprinting

Pedigree interpretation
Inheritance patterns
CODIS. Practical use of STR analysis
Genetic fingerprinting by PCR

6. Forensic genetics in the 21st century

Markers and probabilistic analysis
Bayesian analysis
Massive sequencing (NGS) in forensic genetics
Forensic genetics of the future: prediction of physical and psychological traits (DNA phenotyping)

7. Physical and electrochemical techniques

Physical techniques: mass and volume measurements. Forensic light sources. Microscopies. Detection of radioactive elements. Electrochemical techniques: measurement of pH and conductivity.

8. Identification of toxic chemicals

Atomic spectroscopy techniques: Emission, Atomic Absorption and Fluorescence, for the identification and quantification of toxic chemical elements

9. Identification of narcotic drugs and toxic substances (I)

Molecular spectroscopy techniques: Ultraviolet-Visible Absorption, Fluorescence Emission, Infrared Absorption and Raman Dispersion, for the identification and quantification of narcotic drugs and toxic

substances.

10. Identification of narcotic drugs and toxic substances (II)

Separation techniques: Electrophoresis, Chromatography, Ionic Mobility Spectrometry and Mass Spectrometry, for identification and quantification of narcotic drugs and toxic substances.

11. Instrumental Techniques Laboratory

This session is intended to give an overview of the techniques described in the theoretical classes, from electrochemical techniques such as pH and conductivity measurement, through separation techniques such as electrophoresis and spectroscopy. Students are familiarized with the handling of the instruments of various spectroscopies such as atomic absorption, molecular fluorescence and UV-Vis absorption. Students will also use different types of forensic lights, as well as radioactivity detectors.

12. The Molecular Genetics Laboratory I: IntroductionFamiliarization with a Molecular Genetics

Familiarization with a Molecular Genetics laboratory. Handling of microvolumes, material handling, explanation and use of basic apparatus.

13. The Laboratory of Molecular Genetics I: biochemical and genetic markers for people identification

Use of biochemical and genetic markers in the identification of individuals: Throughout these three sessions, the aim is to familiarize students with some biochemical and genetic techniques that allow the detection of variability in human populations and their application in the identification of individuals. The aim is that the students, from a series of experimental evidences, will be able to determine the identity of one of the problem samples that will be taken at random among the students attending the practicals.

Each student will have to isolate his/her own DNA and use it to determine his/her genetic sex (sex chromosomes) and genotype for a VNTR (Variable Number of Tandem Repeats) polymorphism. Together with the information obtained by immunological techniques of your blood group, the identity of a test sample will be determined.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Theory	40,00
Laboratory	20,00

Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	10,00
Independent study and work	30,00
Preparation of lessons	50,00
Preparation for assessment activities	0,00
Resolution of case studies	0,00
Total hours	**90,00**

TEACHING METHODOLOGY

The development of the course is structured in weekly session of 2 hours and 30 min and 5 laboratory sessions that will be spread throughout the course.

During the weekly sessions in the classroom the most important aspects of each topic will be reviewed. In these sessions students will be encouraged to actively participate through the inclusion during the sessions of short questions related to the topic.

In the laboratory sessions the students will get in contact with the methodology used in forensic laboratories while also consolidating the knowledge acquired in the theoretical sessions.

Finally, the individual study will be used to consolidate the knowledge acquired and will be evaluated through a written test.

Optionally (if the schedule allows it) students will attend conferences and seminars on issues related to the subject.

EVALUATION

Learning assessment will be determined evaluating different aspects. To do this, the final mark of the subject is calculated based on the marks obtained in the following parts:

Part A: 70% of the final score will correspond to a written test to be held at the end of the course.

Part B: 30% of the final score will correspond to the assessment of laboratory practices. This block will be assessed considering the attendance at laboratory sessions and attitude of the student during the same (30% of the block). The knowledge acquired will be assessed (70% of the block) with the presentation of a report to discuss the results obtained during the practical sessions.

It should be noted that attendance at laboratory sessions is essential to pass the course.

Part C (Portfolio): Throughout the course, and on a voluntary basis, students may individually perform various activities, proposed by the faculty of the subject, on topics related to the subject. In addition, in the last part of the course, students may also prepare voluntarily in groups of 2-4 students a written work, *power point* presentation with embedded video, etc., on the contents of the course as established by the responsible professors. The works will be delivered through the Virtual Classroom in the task created for this purpose. These works may be reviewed with the utilities against plagiarism of the University and may be penalized according to the level of plagiarism of the work. The portfolio may contribute up to 1 additional point to the final grade.

To pass the course, it will be necessary to obtain an overall mark higher than 5/10 between parts A (70%) and B (30%), with a minimum mark of 4.5 / 10 in part A and 5/10 in part B. Students who do not pass the subject in the first call of the course, will keep the grade of the approved part (A or B), if applicable, as well as of part C for the second call.

In case of not passing the subject, only the qualification obtained in part B will be kept, if the student so wishes, up to a maximum of three academic years following the one in which the laboratory practices were carried out.

Students who are not assessed in any of the parts A and B, will appear as NO PRESENTED in the official marks.

REFERENCES

- Lorente, JA (2004). Un detective llamado ADN: tras las huellas de criminales, desaparecidos y personajes históricos. Ed. Temas de Hoy. ISBN: 84-846-0386-5
- Valls, O y Del Castillo, B (1998). ¿Técnicas instrumentales en Farmacia y Ciencias de la Salud¿ Ediciones Piros. Barcelona. ISBN: 84-853-2515-X
- Matthewu E. Jholl (2009). Química e investigación criminal. Una perspectiva de la ciencia forense. Editorial Reverté. Barcelona. ISBN: 978-84-291-5512-9.
- Siegel, Jay A., Mirakovits, Kathy (2010). Forensic Science: the basics (second edition). CRC Press. Taylor and Francis Group. ISBN 978-1-4200-8902-8.
- Müller-Esterl, W. (2008) ¿Bioquímica: Fundamentos para Medicina y Ciencias de la vida¿ Editorial Reverté, Barcelona. ISBN 978-84-291-7393-2
- Pascual, L. i Moltó, MD (1999) Però, què és això de la Genètica?. Universitat de València. ISBN: 84-370-4157-0.
- Francesc Mestres (2022) De generació en generació. Com rebem i transmetem els gens. UB edicions. 978-84-9168-786-3. https://www.edicions.ub.edu/ficha.aspx?cod=14094
- Francisco Antón Barberá, Juan Vicente de Luis Turégano (2012). POLICÍA CIENTÍFICA 2 VOLS. 5ª EDICIÓN. Ed. Tirant lo Blanch. Ciencia Policial. ISBN 978-8490046531
- DNA from the beginning: http://www.dnaftb.org
- Klug WS; Cummings MR; Spencer CA; Palladino MA (2013). Conceptos de Genética. Pearson Education. ISBN-9788415552499 (accesible en castellano desde trobes.uv.es)
- Pierce, B (2016) Genética: Un enfoque conceptual Panamericana ISBN-10: 8498353920 (accesible en castellano desde trobes.uv.es).
- Butler, J. M. (2010). Fundamentals of forensic DNA typing: Biology, technology, and genetics of STR markers. Elsevier Science and Technology Books. Burlington (MA). U.S.A.

- Goodwin, W, Linacre, A y Hadi, S (2011). An introduction to Forensic Genetics. Essentials of Forensic Science. 2 Ed. John Wiley and Sons Ltd. ISBN: 9781119957614
- Herrero S, Ivorra JL, García-Sogo M, Martínez-Cortina, C. 2008. Biochemistry and molecular biology techniques for person characterization. BAMBED 18; 347-353
- Buckleton, J. (2016). Forensic DNA evidence interpretation. 2nd ed. Boca Raton: CRC Press, Taylor & Francis Group
- Houck, M. M. and Siegel, J. A. (2015). Fundamentals of forensic science. Academic Press. Burlington (MA). U.S.A.
- Li, R. (2015). Forensic Biology. 2nd ed. Boca Raton, Fl : CRC Press
- Primorac, D. and Schanfield, M. (ed.) (2014). Forensic DNA applications. An interdisciplinary perspective. CRC Press. Boca Raton (FL).
- Klaassen, Curtis D., Watkins III, John B. (2005). CASARETT Y DOULL: FUNDAMENTOS DE TOXICOLOGÍA. Ed. McGraw-Hill. 2005. ISBN: 8448605349
- Skoog, Douglas A. and Leary, James J. (2000). PRINCIPIOS DE ANÁLISIS INSTRUMENTAL. Editorial: MCGRAW-HILL. Año de edición: 2000. ISBN: 978-84-481-2775-6
- Francis Rouessac (2003). ANÁLISIS QUÍMICO: MÉTODOS Y TÉCNICAS INSTRUMENTALES MODERNAS. Mcgraw-Hill / Interamericana De España, S.A. 5ª Ed. ISBN: 9788448137854
- International Society for Forensic Genetics: www.isfg.org
- DNAi.org (DNA interactive): http://www.dnai.org/index.htm