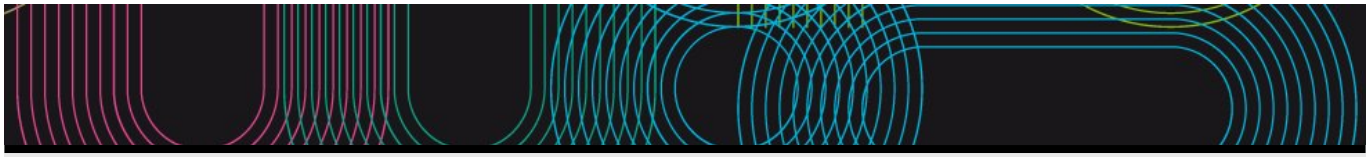

IDENTIFYING DATA				
Introduction to Nanoscience and Nanotechnology				
Subject	Introduction to Nanoscience and Nanotechnology			
Code	V11M188V01101			
Study programme	Máster Universitario en Nanociencia y Nanotecnología			
Descriptors	ECTS Credits	Choose	Year	Quadmester
	6	Mandatory	1st	1st
Teaching language	Spanish Galician English			
Department				
Coordinator	Pérez Juste, Ignacio			
Lecturers	Alonso Gómez, José Lorenzo de Chiara Prada, Loretta Hervés Beloso, Juan Pablo Igea Fernández, Ana Pérez Juste, Ignacio			
E-mail	uviqpipj@uvigo.es			
Web	http://www.usc.gal/gl/estudos/masteres/ciencias-saude/master-universitario-nanociencia-nanotecnoloxia/20212022/introducion-nanociencia-nanotecnologia-17796-17028-2-98991			
General description	This introductory subject aims to provide the student with the necessary foundations to understand the concepts that will be developed in the different subjects that make up the Interuniversity Master in Nanoscience and Nanotechnology.			

Training and Learning Results
Code

Expected results from this subject	
Expected results from this subject	Training and Learning Results

Contents
Topic

Chemistry Block	Exhibition class program (11 h) - Unit 1.- Fundamentals of Spectroscopy: Radiation-matter interaction. (1 teaching hour). Quantum mechanical basis of the interaction of radiation and matter. Types of molecular spectra. Selection rules. Rotation spectra. Intensity and width of the bands. Lambert-Beer law. - Topic 2: Infrared spectroscopy (1 hour lesson). Vibration of diatomic molecules. IR spectrum of diatomic molecules: selection and intensity rules. Harmonicity of vibrations. Residual energy and dissociation energy. Fine rotating structure. IR spectra of polyatomic molecules: normal modes of vibration. Fundamental bands, harmonics, combination bands. Characteristic frequencies. Applications of IR spectroscopy. - Unit 3: Raman spectroscopy (2 teaching hours). Radiation-matter interaction. Raman effect. Rotation and vibration-rotation Raman spectrum. Raman displacement. Origin of Raman scattering: Polarizability. Selection rules and active modes. Raman and fluorescence. Applications of Raman spectroscopy - Unit 4: Electron spectroscopy and fluorescence. (1 teaching hour). Electronic energy levels in diatomic molecules. Electronic spectra of diatomic molecules. Selection rules. Vibration structure. Frank-Condon principle. Electronic spectra of polyatomic molecules. Types of electronic transitions. Chromophores and auxochromes. Electronic deactivation processes. Fluorescence and phosphorescence. - Unit 5.- Chemical kinetics (1 teaching hour). Kinetic vs thermodynamic. Reaction speed. Speed law and reaction order. Variation of the speed constant with temperature. Catalysis. Reaction mechanisms. - Unit 6.- Intermolecular forces. (1.5 teaching hours). Types of non-covalent bonds. Solvation and bonding. Stability of dissolving Host-Guest complexes. Supramolecular systems characterization. Applications. - Unit 7.- Macromolecules. Structure and characterization. (1.5 teaching hours). Open oligomers. Macrocycles. Molecular boxes. Chirality versus geometry. Conformational freedom. Applications. - Unit 8.- Chirality: Chirooptic responses and applications. (2 teaching hours). Polarized light. Fundamentals of chirooptical spectroscopy. Types of chirooptical spectroscopy. Prediction of chirooptic responses. Applications in structural determination and sensing. Seminar program (7 teaching hours) Seminar 1: Fundamentals of spectroscopy (1 teaching hour) Seminar 2: IR Spectroscopy (1 teaching hour) Seminar 3: Raman Spectroscopy (1 teaching hour) Seminar 4: Chemical Kinetics (1 teaching hour) Seminar 5: Intermolecular forces (1 teaching hour) Seminar 6: Macromolecules. Structure and characterization. (1 teaching hour) Seminar 7: Chirality: chirooptical responses and applications. (1 teaching hour)

Physics Block	Physics Block Exhibition class program (10 h) - Unit 1. Introduction. Materials and their characteristics: Metals and Alloys, Ceramics, Polymers, Composite Materials, Nanomaterials. Critical materials. Material design. Material index and material selection maps - Unit 2. Mechanical properties of materials. Stress-strain diagrams: elasticity, plasticity, toughness, fracture, creep. Failures of materials under tension: Repetitive loading and fatigue. Corrosion. Degradation. Hardness. Rugosity. Friction. Types of surface wear - Unit 3. Thermal properties of materials. Heat capacity. Thermal conductivity. Thermal expansion. - Unit 4. Electrical properties. Conductivity. Ohm's law. Electronic and ionic conduction. Conductors, dielectrics and semiconductors. - Unit 5. Magnetic properties. Diamagnetism, paramagnetism and ferromagnetism. Hysteresis. - Unit 6. Optical properties. Electromagnetic radiation. Interaction with solids. Refraction, refractive index. Reflection. Transmission. Absorption. Seminar program Seminar 1: Properties of Materials. Nanomaterials (1 hour lesson) Seminar 2: Mechanical properties of materials. Friction and wear with nanoadditives. (1 teaching hour) Seminar 3: Thermal properties of materials. Thermal nanofluids (1 hour lesson) Seminar 4: Electrical properties of materials, electrical conductivity, Ohm's law (1 teaching hour) Seminar 5: Theory of bands, conductors, dielectrics and semiconductors (1 teaching hour) Seminar 6: Magnetic properties: diamagnetism, paramagnetism and ferromagnetism (1 teaching hour) Seminar 7: Optical properties of materials (1 teaching hour)
Biology Block	Exhibition class program (11 h) Unit 1. The cell (2 teaching hours): Membrane and its potential. Transport through the membrane. Endocytosis. Cell energy needs. Glycid metabolism: glycolysis, Krebs cycle and oxidative phosphorylation. Mitochondria and apoptosis, other forms of cell death. Core. Cellular division. Genomics. Unit 2. Signal transduction (1 hour). Main signaling mechanisms Unit 3. Transportation of solutes and water (1 hour). Body volumes. Principles of the exchange of materials between the different compartments: blood, extracellular and intracellular. Lymphatic circulation. Unit 4. Cardiocirculatory System (2 hours). Organization of the cardiovascular system. Rheology. Arteries, veins and capillaries. Heart like a bomb. Regulatory mechanisms. Unit 5. Respiratory (2 hours). Organization of the respiratory system. I carried oxygen and carbon dioxide in the blood. Ventilatory mechanics and its regulation. Unit 6. Urinary System (1 hour). Organization of the urinary system. Glomerular filtration and renal blood flow Unit 7. Nervous System (1 hour). Organization of the nervous system. Autonomic nervous system. Sensory transduction Seminar program (7 hours) Seminar 1: Genomic sequencing techniques. Seminar 2: Techniques to measure the Membrane Potential. Transmission of the nervous impulse. Seminar 3: Insulin Seminar 4: Transportation Systems. Blood brain barrier. Seminar 5: intestinal absorption. Hepatobiliary function Seminar 6: Blood. Hemostasis Seminar 7: Fundamentals of the interaction of nanomaterials with biological structures

Planning

	Class hours	Hours outside the classroom	Total hours
Lecturing	32	45	77

Seminars	21	52	73
Objective questions exam	0	0	0

*The information in the planning table is for guidance only and does not take into account the heterogeneity of the students.

Methodologies

	Description
Lecturing	Presentation by the teacher of the contents on the subject under study, theoretical and / or guidelines for a job, exercise or project to be developed by the student.
Seminars	Activity focused on the work on a specific topic, which allows to deepen or complement the contents of the subject. They can be used as a complement to the theoretical classes.

Personalized assistance

Assessment

	Description	Qualification	Training and Learning Results
Seminars	- Active participation in seminars, oral presentations and papers (50% of the grade). The active participation of the students will be evaluated through the resolution of questions and problems posed in class, the presentation of works and the intervention in the debates that may arise. Oral presentations will assess expository clarity and the ability to answer the questions that are posed.	50	
Objective questions exam	The evaluation will consist for each block in: - Written exam on the basic contents of the subject (50% of the grade). The examination of the subject, which will be carried out on the date indicated in the corresponding course guide, will consist of short answer questions and problem solving. The maximum score will be 5 points. A minimum score of 2 points is required in this part for the scores of the other two items that are valued to be computed.	50	

Other comments on the Evaluation

Each block will be evaluated separately, requiring a minimum grade of 4 in each of the blocks so that the average between the completed blocks is made.

Sources of information

Basic Bibliography

Bruce Alberts, **Biología molecular de la célula**, Garland Science, 2016

Gerald Karp, **Biología celular y molecular**, McGraw-Hill, 2014

Dee Unglaub Silverthorn, **Fisiología humana: un enfoque integrado**, Ed. Medica Panamericana, 2019

P.W. Atkins, **Química Física**, Omega, 2002

Bertrán, J., Nuñez, J, **Manual de Química Física**, Ariel, 2002

Schlücker, S., **Surface enhanced Raman spectroscopy : analytical, biophysical and life science applications**, Wiley-VCH, 2011

Ira N. Levine, **Fisicoquímica**, McGraw-Hill, 2004

R. Petrucci y otros, **Quimica general**, Pearson Education, 2011

William D. Callister, Jr., David G. Rethwisch., **Ciencia e ingeniería de materiales.**, Reverté, 2016

J. Maza, J. Mosqueira, J. A. Veira, **Física del estado sólido**, manuales universitarios 8, Universidad de Santiago, 2008

J. A. Díaz Navas y J.M. Medina Ruiz, **Ondas de Luz**, Copicentro Editorial . Universidad de Granada, 2013

E. Hecht, **Óptica**, 5ª Edic, Pearson Educación, 2017

E. Hecht, **Teoría y problemas de óptica**, McGraw-Hill, 1990

Complementary Bibliography

Recommendations