Universidad Rey Juan Carlos

TEACHING GUIDE

MEDICAL AND SURGICAL PATHOLOGY II

GRADO EN INGENIERÍA BIOMÉDICA (INGLÉS) (3º y 4º curso) (2374)

ACADEMIC YEAR 2026-27

Q2803011B UNIVERSIDAD REY JUAN CARLOS
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I.-Subject Identification	
Type	OBLIGATORIA
Teaching period	2 course, 1Q semester
Nº of credits	6
Language in wich the subject is taught	English

II.-Presentation

The general objective of this subject is the acquisition of basic theoretical knowledge on the main body systems functions and how they work in a coordinated manner to maintain homeostasis. Knowledge on Human Physiology will allow the student to integrate concepts of other subjects of the first course like Anatomy, Cytology and Histology, and Human Biochemistry. On the other hand, knowledge of the cell functions and of the functions of different systems will allow the students to have sufficient background for subjects of higher courses such as Pharmacology and Medical and Surgical Pathology, since they will allow them to understand fundamental aspects of physiopathology, as well as, of the diagnosis and medical treatment necessary for its application in problems of Biomedical Engineering. It is recommended that the students have knowledge of Biology, Physics, and Chemistry (high school/Baccalaureate completion level) and must have those of Morphology and Biochemistry of the first year. The subject´s program included in this teaching guide is tentative. It can be modified depending on the teaching needs and teaching calendar and/or the healthcare situation. The general objective of this subject is the acquisition of the basic theorical knowledge on the main body system functions and how they work in a coordinated manner to maintain homeostasis.

If the health circumstances so require, the physical attendance will be changed to virtual, in which case it will be mandatory to have a computer with a camera and microphone, as well as internet connection of sufficient bandwidth. For the audiovisual recording of the development of the classes, in the classroom or virtual, in any format (recording of the class in audio and/or video, either on physical or electronic support), prior authorization should be formally requested from the teacher of the subject by the course delegate, under the provisions of the *Ley Orgánica 3/2018, de 5 de Diciembre*, on Data Protection and Guarantee of Digital Rights and subsequent provisions. There can be no audiovisual record without the prior requirement of the master classes, tutorials, practices, seminars, and any other teaching activity. The recordings that have been authorized by the teacher may not be used by the student other than for the purpose of complementing their notes; therefore, the teachers of this subject **DECLINE ALL RESPONSIBILITY** regarding the inappropriate use of the same. Given the dynamics of the master class, it is possible that the professor makes a **UNINTENTIONED** error in the presentation, an error for which they **DECLINE ALL RESPONSIBILITY** since there is the possibility for the student to detect and correct the mentioned error through tutorials, consultation of the recommended bibliography, etc. **The transfer of any type of audiovisual record to third parties through any method by the students is not allowed.** In case of not respecting this regulation, the teaching staff will require the intervention of the URJC academic authorities to formalize the corresponding complaint, sanctioning the offender appropriately. Although it is forbidden to record the classes without the express authorization of the teacher, the teacher can choose to record them, for remote monitoring, or to allow students to connect outside the fixed class times. The **NON- DISSEMINATION** of this material is reminded, as well as, of the tasks used to evaluate attendance and participation in class.

III.-Learning outcomes

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CB1. Proven knowledge and understanding of an area of study based on general secondary education and at a level which, although supported by advanced text books, also includes certain aspects that imply knowledge from the forefront of the field of study.
CB5 . That students have developed the learning skills needed to undertake further studies with a considerable degree of autonomy.
CE01 . Understand or acquire the principles of bioelectrical fundamentals, anatomy, physiology or pathophysiology needed to identify the most appropriate processing technologies for a given problem in biomedical engineering
CE29. Understand the principles of functioning of an organism from the cellular level through the tissue level to the biological system level.
CE33. Understand the biological response to the use of materials and their application in biomedicine

- Key for degrees not adapted to RD 822/21: **CB** - basic competences, **CG** - generic competences, **CE** - specific competences, **CT** - transversal competences.
- Key for degrees adapted to RD 822/21: **CON** - knowledge, **COM** - competences, **HAB** - skills.

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IV.-Contents

IV.A.-Syllabus

THEORICAL CONTENTS

I.- INTRODUCTION TO PHYSIOLOGY FOR BIOMEDICAL ENGINEERING

Unit 1. "Introduction to the study of Physiology". The concept of Physiology. Characteristics of the living being. Levels of organization. Homeostasis: definition and control mechanisms.

II.- BASES OF CELL PHYSIOLOGY AND APPLICATIONS IN BIOMEDICINE

Unit 2. "Functions of the cell membrane: transport". Structure and function of the membrane. Barrier functions: passage of substances through cell membranes. Passive transport and active transport. Transepithelial transport. Applications in Engineering.

Unit 3. "Functions of the cell membrane: communication". Intercellular communication functions. Receptors Signal transduction pathways.

Unit 4. "The genesis of the membrane potential". Origin of the membrane potential. Equilibrium potential and Nernst equation. Role of the sodium pump and the ion channels in the maintenance of the membrane potential. Changes in the membrane potential. Applications in Engineering.

Unit 5. "Graded Potentials and action potentials". Differences between degraded potentials and action potentials. Phases of the action potential. Absolute and relative refractory period. Propagation of the action potential. Applications in Engineering.

III.- BASES OF THE NERVOUS SYSTEM AND APPLICATIONS IN BIOMEDICINE

Unit 6. "Neural Physiology. Synaptic transmission". Types of synapses: electrical and chemical. Neurotransmission. Postsynaptic potentials. Synaptic integration.

Unit 7. "Introduction to the Nervous System". Anatomical divisions: Central Nervous System and Peripheral Nervous System. Functional organization of the Nervous system. Meninges and cerebrospinal fluid. Blood-brain barrier. Fundamental levels of central nervous system function.

Unit 8. "Sensory system ". Organization. Sensation and perception. Receptors and sensory transduction. Types of receivers, classifications. Potential receiver. Identification, location and intensity of sensory stimuli. Receptors of slow adaptation and fast adaptation receivers.

Unit 9. "Somatosensory system". Touch. Tactile receivers. Thermal and pain sensitivity. Descending modulation of pain. Proprioception: Neuromuscular spindle and Golgi organ. Ascending pathways: lemniscal pathway and anterolateral pathway

Unit 10. "Special senses".

- Vision. Structure of the eye and ocular optics. Neurophysiology of vision: role of photopigments of the retina and neural pathways for vision. Applications in Engineering.
- Hearing: hearing and balance. Structure of the auditory system. Mechanisms of sound transduction. Applications in Engineering.
- Balance. Location and function of balance receptors. Applications in Engineering.
- Quimioception: smell and taste. Chemoreceptors. Paths to the cortex.

Unit 11. "Muscle fiber". Muscle types. Skeletal muscle: structure. Applications in Engineering.

Unit 12. "The neuromuscular unit. Excitation-contraction coupling ". Neuromuscular transmission. Motor unit concept. The neuromuscular junction. Motor plate potential. Mechanism of muscle contraction. Energy sources. Types of skeletal muscle fibers.

Unit 13. "Skeletal muscle mechanics". Study of muscle contraction and its regulation. Recruitment and temporary addition, tetanus. Types of contraction: isometric and isotonic. Applications in Engineering.

Unit 14. "Motor system, its control and nervous reflexes". Reflexes: types and their components. Organization of the motor system. Muscle sensory receptors. Levels of motor control. Spinal control of muscle function. Transmission of motor signals to the spinal cord: descending spinal tracts. The function of the motor cortex and brainstem. Global control of movement: basal ganglia and cerebellum.

Unit 15. "Differential characteristics of smooth muscle". Smooth muscle: regulation and contraction mechanisms. Smooth muscle unit and multiunit.

Unit 16. "Autonomous nervous system". Organization. Neurotransmission and autonomous receptors. Functions of the sympathetic and parasympathetic nervous system. Levels of control of the autonomous nervous system.

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Unit 17. "Integrated functions of the Central Nervous System". Electroencephalogram. Hypothalamus and its functions. Ascending activating reticular system. Sleep and wakefulness Limbic system. Learning and memory. Language.

IV. BASES OF THE CARDIOVASCULAR SYSTEM AND APPLICATIONS IN BIOMEDICINE

Unit 18. "Heart and cardiac muscle". Structure and function of the heart. Blood travel. Cardiac muscle: characteristics and mechanisms of excitation-contraction. Auto-excitable cells of heart. Regulation of cardiac rhythmicity. Electrocardiogram. Cardiac cycle. Cardiac expenditure and its control. Differences between skeletal, cardiac and smooth muscle. Applications in Engineering.

Unit 19. "Circulatory system". General Circulation: concepts. Functions of the circulation. Vessels types. Hemodynamics. Tissue blood flow. Blood pressure: factors that determine it and its control. Exchange of substances in the capillaries. Lymphatic system. Applications in Engineering.

Unit 20. "Physiology of the blood". Composition. Blood plasma. Blood cells: erythrocytes, leukocytes and platelets. Hematopoiesis. Hemostasis: mechanisms. Applications in Engineering.

Unit 21. "Immune system ". Components of immune system. Immunity: natural and acquired immune system. Blood types: blood groups. Clinical Applications: immunotherapy.

V. BASES OF THE RESPIRATORY SYSTEM AND APPLICATIONS IN BIOMEDICINE

Unit 22. "Pulmonary respiration, exchange, and transport of gases". Functions of the respiratory system. Respiratory tract. Mechanics of respiration Tests of respiratory function. Gas exchange Transport of oxygen and carbon dioxide.

Unit 23. "Control of breathing". Nervous control: respiratory centers and basic rhythm of breathing. Chemical control. Regulation of alveolar ventilation. Applications in Engineering.

VI. BASES OF THE RENAL SYSTEM AND APPLICATIONS IN BIOMEDICINE

Unit 24. "Renal function". Structure of the renal system. Functions. The nephron as a functional unit. Glomerular filtration, tubular reabsorption and tubular secretion.

Unit 25. "Regulation of electrolyte balance". Mechanisms of concentration and dilution of urine. Antidiuretic hormone. Atrial natriuretic factor. Urination. Applications in Engineering.

VII. BASES OF THE DIGESTIVE SYSTEM AND APPLICATIONS IN BIOMEDICINE

Unit 26. "Functions of the digestive system: secretion, digestion and absorption". General structure. Functions of the digestive system. Digestive processes. Mouth and esophagus: ingestion, chewing and swallowing. Stomach. Regulation of the digestive function. Liver physiology. Pancreatic exocrine secretion. Small intestine. Large intestine. Digestion and absorption of carbohydrates, lipids, and proteins. Defecation. Applications in Engineering.

VIII. BASES OF THE ENDOCRINE SYSTEM AND APPLICATIONS IN BIOMEDICINE

Unit 27. "Introduction to the neuroendocrine system". Types of hormones. Synthesis, storage, and secretion. Regulation of secretion. Hormonal mechanisms of action. Glands of endocrine secretion. Applications in Engineering.

Unit 28. "Organization of the neuroendocrine system". Pituitary hormones. Pineal gland. Hypothalamus as an endocrine control structure. Adenohypophysis. Physiological functions of the adenohypophysial hormones. Neurohypophysis: antidiuretic hormone and oxytocin. Pineal gland: melatonin and circadian rhythms. Applications in Engineering.

Unit 29. "Adrenal and thyroid hormones". Adrenal gland. Mineralocorticoid function: Aldosterone. The function of Glucocorticoids. Hormones of the adrenal medulla. Stress. Thyroid: regulation and functions of thyroxine. Applications in Engineering.

Unit 30."Pancreatic, parathyroid, calcitonin and sexual hormones". Endocrine pancreas. Insulin. Glucagon. Hormonal control of blood glucose. Diabetes. Regulation of calcium and phosphorus. Applications in Engineering.

SEMINARS:

1.Cardiac Cycle

2. Blood pressure regulation

3. pH Regulation

CLINICAL LABORATORY

NEUROLOGIC, NEUROMUSCULAR, CARDIOVASCULAR, RESPIRATORY AND ANTHROPOMETRIC EXPLORATIONS

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Biomedical engineering sits at the intersection of engineering principles and biological systems, aiming to develop technologies and tools that improve healthcare. For biomedical engineering students, a strong foundation in human physiology is not just beneficial, it is essential. This laboratory focuses on five critical areas of physiological exploration: **neurologic, neuromuscular, cardiovascular, respiratory,** and **anthropometric** systems. Understanding how to assess and interpret functions in these domains enables biomedical engineers to design more effective medical devices, diagnostic tools, and therapeutic systems.

Neurologic and neuromuscular explorations aim to assess the integrity and functionality of the central and peripheral nervous systems. These evaluations include testing sensory and motor pathways, reflex arcs, cranial nerve function, and coordination. Such assessments are critical in detecting neurological disorders such as multiple sclerosis, neuropathies, and motor neuron diseases. Neuromuscular evaluations also delve into muscle strength, tone, and endurance, which are vital for diagnosing conditions like myopathies or neuromuscular junction disorders. For biomedical engineers, this knowledge is crucial when designing neural prosthetics, brain-computer interfaces, or diagnostic tools such as EEG systems. Understanding how neural signals are generated and transmitted helps in creating devices that can restore or augment neural function. Biomedical engineers must understand the biomechanics and electrophysiology of muscles to design devices that mimic or support natural movement.

Cardiovascular explorations focus on heart function and blood circulation. Through techniques like blood pressure measurement, heart rate monitoring, and auscultation of heart sounds, future Biomedical Engineers can evaluate cardiovascular health and identify abnormalities such as hypertension, arrhythmias, or murmurs. Understanding cardiac function is essential not only in disease contexts but also in assessing fitness and endurance. This knowledge is essential for engineers developing pacemakers, artificial heart valves, blood flow sensors, and wearable heart monitors. By understanding cardiovascular physiology, engineers can innovate technologies that detect or manage conditions like arrhythmias or heart failure.

Respiratory explorations examine the mechanics of breathing and gas exchange. By measuring parameters such as respiratory rate, lung volumes, and oxygen saturation, students of Biomedical Engineering can evaluate pulmonary health and detect conditions like asthma, chronic obstructive pulmonary disease (COPD), or restrictive lung disease. For biomedical engineers, this area is especially relevant in designing ventilators, oxygen delivery systems, and wearable respiratory monitors. A solid grasp of respiratory mechanics supports the creation of devices critical in emergency medicine, intensive care, and chronic disease management.

Anthropometric measurements provide essential data on body composition, structure, and growth patterns. These include assessments of height, weight, body mass index (BMI), skinfold thickness among others. Anthropometry is foundational in fields ranging from nutrition and physical therapy to ergonomics and pediatrics, offering key indicators of developmental and health status. Biomedical engineers use this data to design ergonomic medical devices, prosthetics, implants, and patient-specific models. Understanding human variation is vital for developing personalized medical solutions and ensuring that devices fit and function safely across diverse populations.

By mastering these explorations, biomedical engineering students not only gain insights into the human body but also build the clinical context needed to create technologies that solve real-world medical challenges. This lab serves as a bridge between theoretical knowledge and its practical, innovative application in modern healthcare

IV.B.-Training activities

Type	Title
Clinical laboratories	Lab. practices, evaluation of neurological, neuromuscular, cardiovascular, and respiratory functions; anthropometric measurements will be also performed. Students attendance to laboratory practices is compulsory.
Theoretical sessions	Masterclasses
Lectures	Seminars
Resolution of exercises, problems, case studies	Evaluation tests

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V.-Student workload	
Theoretical sessions	29
Resolution of exercises, problems, case studies, etc.	14,5
Practical sessions in experimental, technological and clinical laboratories, fieldwork, etc.	13,5
Tests and/or exams	3
Academic tutorials	18
Related activities: conferences, seminars, etc.	30
Preparation of theoretical sessions and self-study	0
Preparation of practical tasks, exercises, case studies, projects, etc.	12
Preparation for tests and/or exams	60
Total student workload	180

VI.-Methodology and academic programme

Type	Period	Content
Theoretical sessions	Week 1 to Week 14	Units 1-30. Lectures will rely on audiovisual material that will be made available to the students. Students¿ attendance is optional. Exposition of contents to the student by the teacher. The active participation of students is necessary. Contingency plan: Physical attendance will be transformed into virtual attendance, the classes will be developed synchronously (live connection), according to the planned schedule, by videoconference through the virtual classroom. The active participation of the students will be encouraged and positively evaluated through question solving. It is recommended to have computer equipment with a camera, microphone, and internet access. if possible, sessions will be held for face-to-face tutoring and resolution of doubts
Resolution of exercises, problems, case studies	Week 1 to Week 14	Problem-solving: The students will carry out different exercises and/or problems related to different thematic blocks in class using different multimedia tools.

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Tests and/or exams	Week 9 to Week 14	The evaluation for the students will consist in a multiple-choice test for the theoretical contents and seminars. For the evaluation of the lab practices, it will be required the solution of problems, short questions, multiple choice test and true or false questions.
Seminars	Week 8 to Week 12	The seminars will follow the same methodology that the theoretical classes. They are distributed throughout the course adapting to the development of necessary theoretical content. The seminars are aimed at integrating different theoretical and practical concepts of the subject, along with other additional content. Every seminar will consist of an exhibition by the professor, a debate with the students, and solving a series of related problems. Assistance to the Seminars is voluntary. The schedule of each seminar will be announced by the professor through the Virtual Campus with at least a week in advance. Disposition of a computer with a camera, microphone, and Internet access is recommended. The seminars will be evaluated with the theory.

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Clinical laboratories	Week 4 to Week 14	Students¿ attendance in laboratory practices is compulsory and will be registered. Laboratory practices will be distributed along the term, paced by the Lectures time-course. The students evaluate the neurological, neuromuscular, cardiovascular, and respiratory functions; anthropometric measurements will be also performed. All the information relative to the practices will be put to student disposition in the script of practices. Failure to attend a practice class must be justified conveniently and the student should communicate it to the teacher with the highest advance so that the possibility of recovering the practice in another group can be arranged. Contingency plan: Physical attendance is required due to the use of necessary material to conducting the explorations only available at the faculty installations. At all times the safety recommendations that dictated by the University and the Faculty for such an effect will be attended. It will be necessary to use the professional uniform (pijamas, jacket, and pants or lab coat) for the performance of laboratory practices of Physiology. If necessary, the practice classes could be replaced by virtual classes with simulators and other audiovisual materials.
Academic tutorials	Week 2 to Week 14	There will be face-to-face tutorships on theoretical content, seminars, laboratories, practices and problems. During these sessions the student will be able to ask the teacher any questions that could not be clarified during the theoretical class sessions. Before going to tutoring, the student will study the content that he or she does not understand and will write down the specific and reasoned doubt. This is intended for the student to first try to resolve the doubt for himself.

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VII.-Assessment methods
The general assessment method is continuous as established in the *Regulation for the Assessment of Learning Outcomes* of Rey Juan Carlos University. All the assessment systems established in the degree report must be employed, except for those that have a minimum weight of 0%, which can be used by professors in the academic years they consider relevant. Each assessment system may be applied through one or more assessment activities, consistent with the system. No assessment activity can exceed individually 60% of the overall grade for the subject. The sum of non re-evaluable activities cannot exceed 40% of the overall grade for the subject and, in general, should not have an established minimum grade (except for practical activities in which, strictly speaking, the conditions of the ordinary call cannot be reproduced in the extraordinary call). Those students who do not manage to pass the subject in the ordinary call, or do not attend this first call, may attend the extraordinary call only for failed re-evaluable assessment activities. The distribution and characteristics of the assessment activities are described below.
VII.A.-Description and weight of the assessment activities

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EVALUATION.

1. Theoretical content and seminars (70%):

The acquisition of theoretical knowledge will be assessed by means of 2 multiple- choice exams: the first part (Topics 1-15) will be held in November and the second part (Topics 16 -30 and seminars) in the ordinary call of January. The qualification of **each partial exam will be equivalent to 35% of the mark for the course**. At least 50% of the total score must be obtained in each partial exam in order to pass the course. The partial will be re-evaluable in the extraordinary call of June. Exam may be replaced by remote assessments using the virtual classroom exam tool.

2. Laboratory practices (20%):

Attendance to practices is mandatory (and is not subject to academic exemption), as well as complying with all the rules detailed in the practice script. To pass the course it is essential to pass the laboratory practices. **The practices will compute 20% of the final mark for the course.** The evaluation of the practices will be carried out by: a) 1 skills test at the end of the course, which will compute **80%** of the total of the practice mark. To pass it is necessary to obtain a minimum grade of 5. If the criterion of attendance to the practices is met, this test will be re-evaluable in the extraordinary summons in June. Exam may be replaced by remote assessments using the virtual classroom exam tool. b) A written test (multiple choice or short questions) at the end of each practice to determine their use. **These written tests in their total will compute 20% of the final practical grade**, being necessary to have all approved practical tests (minimum grade of 5). In the case of having a failed test, it can be recovered in the review session (the maximum mark that can be obtained in the recovery will be a 5). Exam may be replaced by remote assessments using the virtual classroom exam tool.

3. Problem solving in class and active participation in classes (10%):

Although attendance at theory classes and seminars is not compulsory, attendance and participation in class will be evaluated using multimedia tools and will **weight up to 10% of the Final grade** for the course. In order for the student to acquire the competencies of this subject, it is necessary to carry out learning methodologies based on simulations; The student must: practice with other students, carry out different explorations, use or apply evaluation, assessment and treatment techniques, which may involve discovering parts of their body or simulating “pathological situations”. The practices are compulsory and will be always supervised by the teachers; Failure to perform them in accordance with the above will not acquiring the necessary skills and therefore not passing the subject.In order for the student to acquire the competencies of this subject, it is necessary to carry out learning methodologies based on simulations; The student must: practice with other students, carry out different explorations, use or apply evaluation, assessment and treatment techniques, which may involve discovering parts of their body or simulating “pathological situations”. The practices are compulsory and will be supervised at all times by the teachers; Failure to perform them in accordance with the above will mean not acquiring the necessary skills and therefore not passing the subject.

"FOR THE CALCULATION OF THE FINAL GRADE OF THE SUBJECT IT IS ESSENTIAL TO OBTAIN A GRADE OF **AT LEAST 5 POINTS IN EACH EVALUATION TEST** (both in January and June the two partial theory and the practical exam). NO GRADE WILL BE GIVEN. LESS THAN 5 POINTS TO OBTAIN THE FINAL GRADE OF THE SUBJECT.**"**

*In the case of suspension due to plagiarism, the plagiarized activity will be graded with a 0, and in the reevaluation, the maximum grade attainable will be a 5. If advanced tools, such as Artificial Intelligence, have been used in any phase of the activity, it must be specified where and how they were used. If there are indications of abusive, illegitimate, or unacknowledged use of these advanced tools, the instructor will employ verification procedures they deem appropriate. Should these procedures confirm the suspicion that there is no genuine authorship of the activity by the student or students who submitted it, this may be considered equivalent to plagiarism.

**The student who has requested the advanced call must contact the professor responsible for the subject, as soon as possible, to provide him with the information and/or material necessary for the evaluation, which will be similar to what the rest of the courses will follow. students enrolled in the subject.

VII.B. Assessment of students with academic exemption from class attendance

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Having Academic Exemption from Class Attendance (DAAC) does not imply that students are automatically exempt from participating in the continuous assessment activities or in the training activities of compulsory attendance as established in the teaching guide. Once the exemption has been granted, students must contact the subject's teaching staff, who will propose the adaptations he/she may consider relevant, as long as they guarantee the acquisition and adequate assessment of the learning goals established. Students must maintain adequate communication with the teaching staff so that they may provide information on the dates for training and assessment activities, if these are not established in the programme and available for students at the time of achieving the exemption.
Subject with possibility of academic exemption: Yes.

VII.C. Review of assessment activities

In accordance with the Regulation for the Assessment of Learning Outcomes of Rey Juan Carlos University.

VII.D.-Students with a disability or special educational needs

In order to guarantee equal opportunities, non-discrimination, universal accessibility and academic success, students with disabilities or especial education needs may request curricular adaptations to follow their studies. These adaptations will be provided by the Unit of Attention to People with Disabilities of Rey Juan Carlos University, in accordance with the regulation which regulates the service for the Attention of People with Disabilities at the University. This Unit will issue a report for curricular adaptations, so that students with disabilities or special education needs must contact the service (at e-mail discapacidad.programa@urjc.es) in order to provide relevant information for different educational alternatives.

VII.E.-Academic behaviour, academic integrity and honesty

Rey Juan Carlos University is fully committed to the highest standards of academic integrity and honesty, so studying at the URJC means assuming and subscribing to the values of integrity and academic honesty set out in the University's Ethical Code. To support this process, the University has Rey Juan Carlos University's Academic Conduct Regulation as well as different tools (anti-plagiarism, supervision...) that offer a collective guarantee for the full development of these essential values.

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VIII.-Teaching resources and materials
Basic bibliography
TEXT BOOKS 1. **Human Physiology. From cells to systems.** Lauralee Sherwood. Publisher: Cengage 2. **Principles of Human Physiology.** Cindy L. Stanfield. Publisher: Pearson 3. **Guyton and Hall Textbook of Medical Physiology**. Arthur C. Guyton, John E. Hall. Publisher: Elsevier. 4. **Human Physiology: An Integrated Approach**. Dee Unglaub Silverthorn. Publisher: Pearson
Consultation bibliography
ONLINE RESOURCES: 1.https://www.khanacademy.org/science/health-and-medicine/human-anatomy-and-physiology 2.http://www.getbodysmart.com 3.http://www.physiologyeducation.org/ 4.http://www.getbodysmart.com 5.http://www.bayareapainmedical.com/nervanim.html 6.http://www.interactivephysiology.com/login/endodemo/systems/systems/endocrine/index.html 7.http://www.physiologyeducation.org/ 8.http://www.getbodysmart.com **9. https://www.classcentral.com/course/humanphysio-380?utm_source=chatgpt.com** **10.https://www.youtube.com/playlist?list=PLekhl8ZQS2PYEupM94BGahXWjb93Ccn81** **11.https://www.youtube.com/playlist?list=PL8dPuuaLjXtOAKed_MxxWBNaPno5h3Zs8**

IX.-Professors	
Name and surname	JAVIER MARTÍNEZ USEROS
E-mail address	javier.useros@urjc.es
Department	Ciencias Básicas de la Salud
Campus	Fuenlabrada
Category	Profesor/a Permanente Laboral
Academic degree	Doctor
Person responsible for the subject	No
Tutorial timetable	Para consultar las tutorias póngase en contacto con el/la profesor/a a través de correo electrónico
Number of quinquennia	1
Number of sexennia	2
No. of positive evaluations by Docentia	1
Name and surname	ZOE GONZÁLEZ CARNICERO
E-mail address	zoe.gonzalezc@urjc.es
Department	Ciencias Básicas de la Salud

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Category	Profesor/a Ayudante Doctor/a
Academic degree	Doctor
Person responsible for the subject	No
Tutorial timetable	Para consultar las tutorias póngase en contacto con el/la profesor/a a través de correo electrónico
Number of quinquennia	0
Number of sexennia	0
No. of positive evaluations by Docentia	0

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