COURSE DATA

DATA SUBJECT

Code: 34326
Name: Biophysics and biochemistry
Cycle: Undergraduate Studies
ECTS Credits: 6
Academic year: 2025-26

STUDY (S)

Degree	Center	Acad. year	Period
1208 - Degree in Podiatry	Facultat d'Infermeria i Podologia	1	First quarter

SUBJECT-MATTER

Degree	Subject-matter	Character
1208 - Degree in Podiatry	Biochemistry	BASIC

COORDINATION

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SUMMARY

The subject Biophysics and Biochemistry is included as a basic, semester-long course taught in the first semester of the first year of the Bachelor's Degree in Podiatry.

The course content is aimed at studying the fundamental conditions of life phenomena and the basic laws and principles of Biophysics and Biochemistry in order to understand the human body.

PREVIOUS KNOWLEDGE

RELATIONSHIP TO OTHER SUBJECTS OF THE SAME DEGREE

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

OTHER REQUIREMENTS

To ensure proper learning of the content in the Biochemistry and Biophysics course, students must have

prior knowledge of basic Chemistry, Physics, and Biology. It is recommended that they also have knowledge of common computer tools and English.

COMPETENCES / LEARNING OUTCOMES

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Know the bases of biophysics, physiology and biochemistry related to the human body. Immediate principles. Biochemistry and biophysics of membranes, muscles and nerves. Acquire knowledge of the functions and regulation of the different organs and systems of the human body.

DESCRIPTION OF CONTENTS

A) Theoretical Content

1. Biophysics I

TOPIC 1. INTRODUCTION TO THE STUDY OF BIOPHYSICS.
What is Biophysics? Historical evolution and role of Biophysics in Health Sciences. Basic concepts of biophysical methodology.

TOPIC 2. FUNDAMENTALS OF BIOMECHANICS: BONE ELASTICITY.
Loads and stresses on the skeletal structure. Concept of elasticity: deformation mechanisms and their laws. Biomechanics of the structure and functionality of compact bone.

TOPIC 3. INTERFACIAL PHENOMENA IN LIQUIDS.
Concept of surface tension. Laplace¿s law for curvature overpressure. Pulmonary surfactant.

TOPIC 4. FLUID DYNAMICS AND BIORHEOLOGY.
Flow regimes. Concept of viscosity. Properties of blood viscosity.

TOPIC 5. PHYSICAL FUNDAMENTALS OF HEMODYNAMICS.
Poiseuille-Hagen law. Relationship between flow, pressure, and resistance. Factors affecting resistance. Turbulence: Reynolds number.

TOPIC 6. FLUID CIRCULATION IN ELASTIC CONDUITS.
Vascular pressure and tension. Wave propagation through an elastic membrane: Pulse wave velocity.

TOPIC 7. SEPARATION PHENOMENA OF SOLID PARTICLES IN SUSPENSION.
Sedimentation velocity. Ultracentrifugation. Sedimentation techniques.

TOPIC 8. ENERGY TRANSPORT.
Particle and wave phenomena. Material and electromagnetic waves. Concepts of frequency, period, and wave intensity.

TOPIC 9. PHYSICAL PRINCIPLES OF ULTRASONIC DIAGNOSIS.
Concept of ultrasound. Specific physical characteristics. Production and detection: transducers.

TOPIC 10. DOPPLER ULTRASOUND.
Doppler effect. Continuous and pulsed techniques.

TOPIC 11. MEMBRANE PROPERTIES AT REST.
Causes of membrane potential. Diffusion: Fick¿s law. Membrane permeability coefficient.

TOPIC 12. PASSIVE TRANSPORT IN THE CELL MEMBRANE.
Electrical characteristics of the study. Nernst-Planck electrodiffusion equation. Passive transport mechanisms.

2. Biophysics II

TOPIC 13. RESTING POTENTIAL OF EXCITABLE CELLS.
Nernst equation for ionic equilibrium potential. Generation of a membrane potential difference. Passive transport imbalance: Goldman equation. Active transport: Na-K pump (Na-K ATPase).

TOPIC 14. ACTION POTENTIAL.
Cell excitability. Action potential: concept and phases. All-or-nothing law. Refractory period. Influence of stimulus intensity.

TOPIC 15. IONIC INTERPRETATION OF THE ACTION POTENTIAL.
Types of ion channels. Voltage-gated channel proteins. Explanation of action potential properties.

TOPIC 16. CONDUCTION OF THE ACTION POTENTIAL.
Conduction mechanisms. Unmyelinated fibers: local currents. Myelinated fibers: saltatory conduction.

TOPIC 17. SYNAPTIC TRANSMISSION: ELECTRICAL SYNAPSES.
General aspects of synaptic transmission: electrical and chemical synapses. Functional basis of electrical synapses.

TOPIC 18. CHEMICAL SYNAPSES. PRESYNAPTIC EVENTS.
Functional basis of chemical synapses. Presynaptic phenomena. Neurotransmission: concept and characteristics.

TOPIC 19. CHEMICAL SYNAPSES. POSTSYNAPTIC PROCESSES.
Ionotropic and metabotropic synaptic receptors. Neurotransmitter-gated channel proteins. Excitatory and

inhibitory synaptic actions. Concept of synaptic integration.

TOPIC 20. PROPERTIES OF SKELETAL MUSCLE CONTRACTION.
Electrical phenomena in muscle. Muscle contraction process. Energy consumption during contraction and relaxation.

3. Biochemistry

TOPIC 21. INTRODUCTION TO BIOCHEMISTRY: THE CELL.
The living cell as a chemical factory. Structure of prokaryotic and eukaryotic cells. Biochemical functions of the main cellular organelles.

TOPIC 22. AMINO ACIDS, PEPTIDES, AND PROTEINS.
Types of amino acids, amino acids modified in proteins, protein synthesis. Protein structure and classification.

TOPIC 23. VITAMINS AND BIOELEMENTS.
Water-soluble and fat-soluble vitamins. Bioelements.

TOPIC 24. ENZYMES.
Enzyme properties. Enzyme classification. Enzyme kinetics. Catalysis. Enzyme regulation and diagnostic value.

TOPIC 25. NUCLEIC ACIDS.
Biochemistry of nucleic acids. DNA replication. DNA mutations and repair. Cancer.

TOPIC 26. LIPIDS AND MEMBRANES.
Types of lipids. Fatty acids. Isoprenoids. Steroids. Diseases related to sphingolipid storage.

TOPIC 27. CARBOHYDRATE METABOLISM.
Glycolysis. Krebs cycle. Gluconeogenesis. Metabolism of other sugars. Glycogen metabolism.

TOPIC 28. PROTEIN METABOLISM.
Digestion and absorption. Amino acid anabolism. Protein anabolism. Protein catabolism.

TOPIC 29. LIPID METABOLISM.
Fatty acids and triacylglycerols. Membrane lipid metabolism. Cholesterol metabolism and steroid hormone synthesis.

TOPIC 30. CLINICAL BIOCHEMISTRY.
In vitro and in vivo study of biochemical properties to provide information for the prevention, diagnosis, prognosis, and treatment of diseases.

B) Practical Content

5. Seminar Practical Classes:

1. Calculations of elasticity and surface tension.
2. Calculations in fluid dynamics and hemodynamics.
3. Electrophysiology calculations. Determination of the Nernst equation.
4. Application and diagnostic value of lipids, carbohydrates, and proteins.
5. Clinical biochemistry case studies.

6. Laboratory Practical Classes:

1. Experimental measurement of elastic constants; quantitative determination of Young¿s modulus of a sample.
2. Verification of the Nernst equation.
3. Handling of specimens and biochemical alterations.
4. Instrumentation for biochemical determinations.

WORKLOAD

PRESENCIAL ACTIVITIES

Activity	Hours
Tutorials	2,00
Theory	40,00
Laboratory	8,00
Classroom practices	10,00
Total hours	**60,00**

NON PRESENCIAL ACTIVITIES

Activity	Hours
Attendance at other activities	0,00
Individual or group project	5,00
Independent study and work	40,00
Preparation of lessons	10,00
Preparation for assessment activities	30,00
Resolution of case studies	5,00
Total hours	**90,00**

TEACHING METHODOLOGY

Biophysics:

- **Lectures** with presentations by the instructor and possible student participation.
- **Seminar practical classes** with discussion among participants on supplementary topics, numerical exercises, and oral/written student contributions.
- **Laboratory practical classes** to acquire skills in the use of measuring instruments and data processing related to the program¿s content.

Biochemistry:

- **Lectures** with presentations by the instructor and possible student participation.
- **Seminars** with peer discussion on supplementary topics.
- **Theoretical-practical laboratory classes** aimed at skill acquisition in using measuring instruments and processing results related to the program content. Audiovisual materials are provided, but the main learning sources are the texts recommended by the instructor.
- Some topics may be developed and presented by student groups under teacher guidance to encourage active participation, address doubts, and request additional information.

EVALUATION

Theoretical Evaluation:

- **60%** of the final grade.
- Based on a written or oral test covering theoretical content to assess knowledge acquisition.

Practical Evaluation:

- **40%** of the final grade.
- Based on a test evaluating skills related to practicals and seminars.

EVALUATION CRITERIA FOR THE BIOPHYSICS¿BIOCHEMISTRY COURSE

Biophysics

- **Single exam** covering both theoretical and practical parts.
- **Theory: 60%**
    - 15 multiple-choice questions (4 options each)
    - Worth **3 points**
- **Practice: 40%**
    - 10 multiple-choice questions (4 options each)
    - Worth **2 points**
- **Attendance:**
    - **Mandatory 80% minimum.**

- If attendance is below 80%, a preliminary exam on practices and seminars is required.

Biochemistry

- **Theory: 60%**
  - 40 multiple-choice questions (4 options each)
  - **Wrong answers deduct 0.25 points**
  - Worth **3 points**
- **Practice: 40%**
  - Practical exam with 15 multiple-choice questions (4 options each)
  - **Wrong answers deduct 0.25 points**
  - Worth **2 points**
- **Attendance:**
  - Attendance to practical sessions is **mandatory**.

Remarks:

a) To pass the course, students must obtain at least **50% in both Biophysics and Biochemistry** parts.
b) If only one part is passed, that score is valid **only for the second exam session**, not for the following academic year.
c) In Biochemistry, the **practical grade is only added if at least 50% of the theory is passed**.
d) Completed and passed practicals are valid for **one year**.

If any part of the evaluation is failed, the transcript will reflect the **grade of the failed part**. If both are failed, the higher of the two failing grades will be recorded.

The practical part is evaluated **together with the theory** in each exam session. If a student fails one part in

the first session, they may **retake it in the second session**.

REFERENCES

- 1. Catalá J. (1978). Física. Madrid. 2. Trudy McKee y James R McKee. (2009). Bioquímica. Las bases moleculares de la vida. México D.F.: McGraw-Hill/Interamericana. 3. Frumento A. (1995). Biofísica. Barcelona: Mosby/Doyma.

- 1. Stryer, L. (1995). Bioquímica. Barcelona: Reverté. 2. Nelson D.L., Cox M.M. (2007). Lehninger. Principios de Bioquímica. OMEGA, 2007. 3. Aurengo A, Petitclerc T. (2008). Biofísica. Madrid: McGraw-Hill/Interamericana. 4. Nájera A, Arribas E, Navarro JD, Jiménez L. Fundamentos de Física para Profesionales de la Salud. Elsevier España, Barcelona, 2015. ISBN 978-84-9022-859-3. (Disponible en formato electrónico en la Biblioteca UV).