

ANNEX 1

SYLLABUS

1. Study Program Data

1.1 High Education Institution	UNIVERSITY OF MEDICINE AND PHARMACY "VICTOR BABES" TIMISOARA
1.2 Faculty	MEDICINE
1.3 Department	III - FUNCTIONAL SCIENCES
1.4 Study Domain ¹⁾	MEDICINE
1.5 Cycle Studies ²⁾	License
1.6 Study programme/ Qualification	GENERAL MEDICINE -ENGLISH SECTION

2. Discipline data

2.1. Discipline name	ADAPTIVE PHYSIOLOGY - INTEGRATIVE REGULATORY MECHANISMS WITH CLINICAL APPLICABILITY							
2.2 Course staff	1. Prof. Dr. Carmen Panaitescu 2. S.I. Dr. Haidar Laura 3. S.I. Dr. Georgescu Marius 4. S.I. Dr. Raul Pătraşcu							
2.3 Practical activity staff	1. Asst. Univ. Dr. Goţia Laura 2. Asst. Univ. Dr. Calma Crenguţa 3. Asst. Univ. Drd. Bolocan Alexandru 4. Asst. Univ. Drd. Zimbru Răzvan 5. Asst. Univ. Drd. Alexandru Tirziu							
2.4 Year of study	II	2.5 Semester	II	2.6 Type of evaluation	Colloquium	2.7 Discipline regime	Content	DS
							Obligatory	DO

3. Duration/Estimated Time (number of hours/ semester of teaching activity)

3.1 Number of hours/ week	4	3.2 of which: lecture	2	3.3 of which: practical laboratory	2
3.4 Total hours of curriculum	56	3.5 of which: lecture	28	3.6 practical laboratory	28
Distribution of available time					hours
Study of the textbook, course material, bibliography and notes					20
Further documentation in the library, on specialist electronic platforms and in the field					10
Preparation of seminars/labs/projects, homework, portfolios and essays					8
Tutoring					4
Examinations (1 practical exam, 1 final colloquium)					2
Other activities					-
3.7 Total individual study hours	44				
3.8 Total hours per semester	100				
3.9 Number of credits ⁵⁾	4				

4. Preconditions (if applicable)

4.1 of curriculum	Disciplines required to be previously learned for good understanding and performance of the educational process in Physiology: Anatomy, Biophysics, Cellular Biology, Biochemistry.
4.2 competences	Not applicable

5. Conditions (if applicable)

5.1 course schedule	<ul style="list-style-type: none"> • Mobile phones will be switched off during lectures, phone calls during class will not be tolerated, nor will students leave the classroom to take personal phone calls; • Tardiness will not be tolerated as it is disruptive to the educational process;
5.2 seminar/lab/project schedule	<ul style="list-style-type: none"> • Mobile phones will be switched off during lab hours, no phone calls will be tolerated during lab hours and students will not be allowed to leave the classroom to take personal phone calls; • Tardiness of students to the lab will not be tolerated as it is disruptive to the educational process; • Attendance at internships/practicals is mandatory, with a maximum of 30% of total absences accepted. • Up to 40% of the total number of paid absences in the penultimate week of the semester may be recuperated (except in medical cases, which will require individual approval from the Dean). • The practical examination will be taken in the regular session, from the practical work topic posted in advance.

6. Specific competences acquired

Skills Professional	1. Students will be able to explain the interconnectedness of the afferent and efferent mechanisms that coordinate brain, heart and kidney functions with a role in regulating blood pressure and water-electrolyte balance; they will be able to describe the adaptive response to significant changes to homeostasis (e.g: changes in BP, volemia, ion balance, stress, physical exertion); will learn the ability to clinically differentiate a physiological response, leading to steady-state, from a pathological response, leading to disease (hyper-/hypertension, water-electrolyte imbalance); will be able to identify the main methods of restoring BP and water-electrolyte balance to physiological limits.
	2. Students will be able to explain why acid-base balance is an essential component of the human body's homeostasis and why it requires multiple regulatory systems; they will be able to describe how this process of adaptation to changes in the external and internal environment is achieved and what the main methods are for returning the concentration of H ⁺ ions to physiological limits; understand the effects of maintaining pH within physiological range - this ensures the normal functioning of enzyme systems, contributes to normal transmembrane transport, ensures adequate content of the intracellular environment, has consequences for metabolism and cell polarisation; learn the ability to differentiate paraclinically between a physiological response, with return to <i>steady-state</i> , and a pathological response in a disease (e.g. metabolic acidosis through ketoacidosis in decompensated diabetes mellitus, metabolic alkalosis through aldosterone hypersecretion).
	3. Students will be able to understand the relationship between ECG and cardiac echocardiography; interpret the ECG elements integrated in the 12 leads as well as the basic elements of echocardiography with differentiation between phases of cardiac revolution; assess ejection fraction and acquire echocardiographic concepts necessary for assessing inotropic and diastolic function.
	4. Students will be able to describe the mechanisms involved in the bronchomotor response to exposure to different environmental factors; they will be able to assess the bronchomotor response by interpreting bronchoprovocation tests (bronchoconstriction, bronchodilation). Based on the knowledge acquired, students will be able to understand the clinical significance of these tests and their relevance to the functional assessment of the respiratory system.

5. Students will be able to describe the changes induced on cardiovascular parameters by physical exertion and identify the mechanisms by which adaptation to exertion is achieved; they will be able to discuss the mechanisms involved in the redistribution of blood flow to the central nervous, coronary, splanchnic, cutaneous and musculoskeletal systems during severe physical exertion. They will be able to identify and detail the adaptive responses of different categories of performance athletes compared to untrained individuals, analysing the benefits of moderate exertion and the risks of extreme physical exertion. They will be able to discuss the main mechanisms of thermogenesis and thermolysis, describing the neuro-endocrine mechanisms involved in acclimatisation to heat and cold, respectively.
6. Students will be able to list hormones with a hypoglycaemic effect (insulin) and hormones with a hyperglycaemic effect (glucagon, glucocorticoids, thyroid hormones, STH, catecholamines). They will acquire the ability to describe the mechanisms by which insulin lowers blood glucose by detailing its effects on the hepatocyte, fat cell, and muscle fiber. They will acquire the ability to describe the mechanisms by which hyperglycaemic hormones produce this effect on glucose metabolism. Students will be able to explain the effects of the sympathetic and parasympathetic vegetative nervous system on blood glucose. Students will be able to describe the physiological regulatory mechanisms triggered by the lowering and raising of blood glucose, respectively.
7. Students will be able to list the main hormones involved in maintaining phosphocalcic balance (PTH, vitamin D, calcitonin). Students will acquire the ability to describe target organs and the effects and mechanisms of PTH secretion regulation. Students will be able to describe the sources of vitamin D, its biosynthetic pathways, and the organs involved in the activation of 1,25-dihydroxycholecalciferol. They will acquire the ability to describe the cells that are producing calcitonin and the effects and stimulatory signals for calcitonin secretion. They will be able to describe the physiological regulatory mechanisms triggered by the decrease and increase of calcemia, respectively. They will relate the structural characteristics of bone to the physiological mechanisms involved in bone turnover (calcification and bone resorption) and describe the effects of the main hormones involved in bone metabolism.
8. Students will be able to describe the most crucial roles of the liver, correlate the structure of the liver with the main liver functions. They will be able to describe the major role of the liver in maintaining homeostasis and its intervention in all metabolisms, its functional interrelationships with other major organs, and its great capacity for regeneration.
9. Students will be able to explain the role of the microbiome-brain-gut axis in mental health, describe the changes induced by different factors (nutrition, stress, age, gender) on the gut microbiome. They will be able to list methods for assessing the gut microbiome-brain axis. They will understand fundamental aspects of the biology of the gut microbiome and how it and the brain influence each other. They will also be able to explain how the microbiome in early life influences health throughout life and describe therapeutic approaches based on microbiome modulation to improve health.
10. Students will be able to describe the role of hypothalamic centres in regulating feeding, detailing the interrelationship between first and second order neurons and the involvement of each type of neurotransmitter. They will be able to discuss hypothalamic ponderostat theory based on the mechanisms involved in regulating long-term food intake and body weight maintenance, highlighting the complex involvement of peripheral orexigenic and anorexigenic peptides, especially adipose tissue leptin. They will be able to discriminate between short-term and long-term mechanisms of food intake regulation, highlighting the different levels of control and signaling mechanisms involved. They will be able to describe how the hypothalamus integrates two control systems for normal body function, thermoregulation and regulation of nutrient intake.

	<p>11. Students will be able to distinguish the functions of different types of somatosensory receptors, know the main functional characteristics of the ascending somatosensory pathways, identify the somatosensory areas involved in the projection of somesthetic sensations. They will be able to describe the functional organization of the motor cortex and the role of each motor area in the control of voluntary and automatic motor activity; they will be able to differentiate between the functional characteristics of the descending pyramidal and extrapyramidal motor pathways. They will be able to describe the roles of each functional division of the cerebellum as well as the functional connections of the basal nuclei with discussion of the role of neurotransmitters involved in these neural circuits. Based on the knowledge acquired, students will understand the clinical significance of the main functional sensory and motor changes.</p>
	<p>12. Students will be able to detail the organization of the cerebral cortex based on neurophysiological criteria, describe the roles of the primary motor areas and differentiate them from those of the premotor, supplementary motor, and specialized motor areas. They will be able to differentiate between primary sensory areas where elementary sensations occur and secondary areas where complex integration of elementary sensations occurs. They will be able to explain the role of the associative regions in constructing a perceptual experience of the world, assigning meaning to experiences, interacting effectively with the environment, supporting abstract thought and language; they will be able to differentiate the gnostic function and praxical function of different associative areas in the cerebral cortex. Students will understand the concept of neuroplasticity and the implications of this phenomenon in dominant hemisphere theory</p>
	<p>13. Students will be able to identify the mechanisms that integrate intellectual functions and processes such as perception, attention, thinking, intelligence, knowledge formation, memory and working memory, judgment and evaluation, reasoning and calculation, problem-solving and decision making, understanding, and language. Based on their knowledge of models of information processing, students will be able to identify the main types of memory and their functional characteristics, be able to describe the main theories of learning mechanisms, describe the role of emotions and hormones in the learning process, detail the involvement of hippocampal structures in memory and detail the cellular and molecular mechanisms involved in memory consolidation.</p>
	<p>14. Students will be able to describe the components of the vegetative nervous system, distinguish between the characteristics of the vegetative and somatic nervous system, and between the sympathetic and parasympathetic vegetative nervous system. They will be able to describe the integrative role of the vegetative nervous system's control of the body's functions.</p>
Transversal skills	<ol style="list-style-type: none"> 1. Concern for professional development by training critical thinking skills demonstrated through active participation in course and lab/seminar/project; 2. Involvement in scientific research activities through participation in the preparation of reports, studies, and articles; 3. Efficient use of information sources and communication and assisted training resources (Internet portals, specialized software applications, databases, online courses, etc.) both in Romanian and in an international language.

7. Subject objectives (derived from the specific competences acquired)

7.1 General objective of the subject	<ul style="list-style-type: none"> • Integrative presentation of the functions of the apparatus and systems (cardiovascular, respiratory, renal, endocrine, nervous) to underpin the understanding of basic concepts in pathophysiology and clinical practice, complementing the first year physiology courses. • Theoretical preparation of students to be able to assimilate knowledge, through systematized information on functional integration phenomena
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	<p>based on the interrelationship between the different apparatuses and systems.</p> <ul style="list-style-type: none"> • Illustration of theoretical concepts by demonstrative presentation of classical experiments in practical work illustrating the applicability of the acquired concepts in clinical practice. • Acquire practical skills in the correct performance of functional explorations based on the rigour of the procedures and understanding of the phenomena explored and the principles of the techniques. • To educate students in the spirit of the rigour of the medical act and the understanding of the determining role of basic sciences for its level and for their professional training.
7.2 Specific objectives	<ol style="list-style-type: none"> 1. Understanding the neuro-humoral mechanisms involved in the control of blood pressure (BP) and water-electrolyte balance; assessing the importance of each mechanism and identifying the regulatory mechanisms with a major role - focusing on the role of the renin-angiotensin system and the autonomic nervous system. 2. Understanding the mechanisms regulating acid-base balance: intracellular and extracellular buffer systems, respiratory and renal mechanisms involved; understanding the importance of each mechanism, and the interrelationship between all these elements. 3. Integrative understanding of electrophysiological and echocardiographic assessment methods of cardiac function. 4. Knowledge of the bronchomotor response to exposure to pathogens, allergens, noxins, pollutant particles - mediators, receptors, mechanisms involved. Understanding the defence mechanisms of the system against different harmful environmental factors. Description of the effect and mode of action of bronchoconstrictor and bronchodilator medication. Knowledge of the mechanisms of neuro-humoral control of the bronchomotor response (sympathetic and parasympathetic vegetative nervous system, non-adrenergic non-cholinergic system, hormones). 5. Integrated understanding of the cardiovascular, respiratory, metabolic and biochemical adaptive responses that occur during physical exertion and discussion of the magnitude of these changes as a function of the degree of training and the type and intensity of exertion performed. Comparative approach to stress-induced changes and presentation of the body's reaction to exposure to extreme temperatures. 6. Knowledge of hormones with hypoglycaemic effect (insulin) and hormones with hyperglycaemic effect (glucagon, glucocorticoids, thyroid hormones, STH, catecholamines). Description of the mechanisms by which insulin lowers blood glucose by detailing its effects on the hepatocyte, fat cell and muscle fibre. Description of the mechanisms by which hyperglycaemic hormones produce this effect on glucose metabolism. Knowledge of the effects of the sympathetic and parasympathetic vegetative nervous system on blood glucose. Description of the physiological regulatory mechanisms triggered by the lowering and raising of blood glucose respectively. 7. Knowledge of the main hormones involved in maintaining phosphocalcic balance (PTH, vitamin D, calcitonin). Presentation of target organs, effects, and mechanisms of regulation of PTH secretion. Identification of vitamin D sources, biosynthesis pathways, and organs involved in 1,25-dihydroxycholecalciferol activation. Description of the producing cells, effects and stimulatory signals for calcitonin secretion. Description of

	<p>the physiological regulatory mechanisms triggered by calcemia depletion and elevation, respectively. Knowledge of the structural components of bone and the physiological mechanisms involved in bone turnover (calcification and bone resorption). Description of the effects of hormones on bone (STH, thyroid hormones, insulin, cortisol, sex hormones).</p>
	<p>8. Knowledge of the functional areas of the hepatic acin in correlation with their most important roles, the hemodynamic peculiarities of hepatic circulation and lymph formation. Analysis of the physiological implications of the main biochemical processes within the metabolism and how they fit into the general concept of homeostasis. Describe the function of the liver as a haematopoietic organ and how it is involved in erythrocyte degradation. Describe aspects of biligenetic, depot, endocrine function and the mechanisms by which the liver intervenes in water-electrolyte balance. To specify the role of the hepatocyte and the Kupffer cell in clearance mechanisms, hepatic detoxification and body defence.</p>
	<p>9. Presenting the role of commensal gut bacteria in the brain-gut axis. Understanding the relationship between the gut microbiome and brain function. Knowledge of the effects of the microbiome on behaviour and the immune system.</p>
	<p>10. Detailed knowledge of the complex neuro-endocrine mechanisms involved in the regulation of food intake both in the long term, with implications in maintaining weight balance, and in the short term, with highlighting the role of local gastrointestinal hormones in modulating brain-gut axis functionality. Highlighting the importance of each of the nutritional principles in maintaining metabolic balance and health.</p>
	<p>11. Presentation of vegetative adrenergic and cholinergic mediation (synthesis, storage, metabolism) and types of adrenergic and cholinergic receptors (distribution, affinity, intracellular signalling mechanisms). Knowledge of the effects and assessment of the importance of sympathetic and parasympathetic stimulation on body functions.</p>
	<p>12. Knowledge of the general principles of organization of the nervous system, description of the functional characteristics of the somatosensory component, definition of nociception and description of pain modulation mechanisms and understanding of the main mechanisms involved in the control of elementary motor and voluntary and involuntary motor.</p>
	<p>13. Description of the functional organization of the cerebral cortex, and of the role and functional connections of the main cortical areas with a motor role, a sensory-sensory role and an associative-integrative role. Approach the dominant hemisphere theory from the perspective of current knowledge based on advanced neuroimaging studies and long-term follow-up of clinical cases.</p>
	<p>14. Addressing the physiological mechanisms involved in cognition, which refers to the mental action or process of acquiring knowledge and understanding through thought, experience and the senses. Describing the mechanisms of memory, the process by which knowledge is consciously or unconsciously encoded, stored, retrieved or remembered, from the brain circuits involved to the molecular mechanisms of engramation.</p>

8. Content

8.1 Course		Teaching methods	Number of hours	Observations
1. Neuroendocrine coordination mechanisms of the brain-heart-kidney axis with a role in blood pressure regulation and water-electrolyte balance		Interactive lecture	2	<ul style="list-style-type: none">Oral lecture supported by structured, interactive Powerpoint presentations, accompanied by rich and suggestive iconography, pictures, tables and explanatory diagrams and even small animations simulating the physiological processes in the body.Courses are available on the university's Moodle e-learning platform.Each course begins with the educational objectives and ends with a summary of the concepts presented (take home messages).
2. Integrated mechanisms of the body's response to acid-base imbalances			2	
3. Electrophysiological and ultrasound assessment of cardiac function.			2	
4. Bronchomotor response to exposure to environmental factors: from physiological mechanisms to bronchial hyperresponsiveness			2	
5. Adaptation to physical effort and stress. Adaptation to environmental conditions - thermoregulation			2	
6. Neuro-endocrine control of blood glucose			2	
7. Phosphocalcic balance and its involvement in bone turnover			2	
8. Physiological basis of liver functions with clinical application			2	
9. Brain-gut axis: the role of the microbiome in homeostasis			2	
10. Controlling food intake. The role of nutrition in maintaining metabolic balance			2	
11. "The brain of the viscera": a review of the function of the vegetative nervous system			2	
12. Somatic sensory and motor nervous system			2	
13. Physiology of the cerebral cortex. Dominant hemisphere theory - current approach			2	
14. Cognition and memory			2	
Bibliography required: 1. Course notes in ppt/pdf format. The information is available on the Moodle e-learning platform on the university website.				
Optional bibliography: 1. Guyton AC, Hall JE, W.B. Saunder, Medical Physiology, 13 th ed., Elsevier, 2016. 2. Costanzo, Linda S. Physiology. Saunders, Philadelphia, 2013 3. Koeppen, Bruce M., and Stanton, Bruce A. Berne & Levy Physiology. Elsevier Health Sciences, 2009 4. Ganong, William F. Review of medical physiology. McGraw-Hill Medical, New York, 2010 5. Boron, Walter F., and Boulpaep, Emile L. Medical Physiology. Elsevier Health Sciences, 2012 6. Boron WF, Boulpaep EL, Tractate of Medical Physiology 3rd edition, ELSEVIER and Hippocrates Publishing House, Bucharest, 2017 1. Silverthorn, Dee Unglaub, Johnson, Bruce R., and Ober, William C. Human physiology. Pearson/Benjamin Cummings, 2010 2. Bunu, Physiology of the cardiovascular system, Ed. Orizonturi Universitare, 2003.				
8.2. Laboratory		Teaching-learning methods	Number of hours	Observations

1. Exploring acid-base balance. Interpretations and presentation of clinical cases	<ul style="list-style-type: none">• Practical demonstrations• Evaluation of parameters generated from functional exploratory investigations• Interactive lecture	2	<ul style="list-style-type: none">• Presentations and demonstrations using functional diagrams, tables and explanatory pictures for methods used in assessing the normal function of various systems and appliances• Practical performance of the respective functional exploration, initially by the group assistant and subsequently by the students under the direct supervision and with the help of the group assistant.• Presentation of typical examples of interpretation bulletins and interactive discussions at the end of each practical work.• Checking the integrative analysis capacity of the main knowledge taught through multiple choice questions at the end of each practical work
2. Exploring liver function. Interpretations and presentation of clinical cases		2	
3. Exploring blood glucose regulatory mechanisms and assessing their functionality		2	
4. Exploring phosphocalcium balance: from biochemical determinations to clinical tests and electromyographic investigations		2	
5. Exploration of cardiac systolic and diastolic function by echocardiography. Phonocardiogram. Cardiac function curves		2	
6. Submaximal cycle ergometer exercise test: interpretation of cardiovascular, respiratory and metabolic parameters		2	
7. Exploring bronchomotricity by challenge testing: interpretation of respiratory functional parameters		2	
8. Assessment of neuroendocrine response under acute and chronic stress conditions		2	
9. Adaptation of the food ration to physiological and pathological demands. Special diets: hypo- and hypercaloric, hypo-, hyperprotein diets and supplements		2	
10. Memory tests. Memory exercises.		2	
11. Reflex nerve activity. Motor nerve conduction velocity. Clinical importance		2	
12. Electroencephalogram: Brain bioelectrical rhythms		2	
13. Exploring vegetative tone		2	
14. Recaps and recoveries		2	
Bibliography required: <ul style="list-style-type: none">1. Practical papers in word and PPT format available on the Moodle e-learning platform.2. C. Panaitescu, D. Nistor, G. Tănăsie, C. Tatu, L. Marusciac, D. Pleșca, A. Gherbon, L. Cernescu, S. Groza, E. Ciurariu, M. Cotarcă, M. Georgescu, P. Tămaș, C. Calma, D. Crîșnic, O. Harich. Human physiology. Practical works. Cardiovascular, respiratory, endocrine, nervous system. Ed. Eurostampa, Timisoara, 2017.3. Carmen Panaitescu, Carmen Tatu, Daciana Nistor, Gabriela Tănăsie, Monica Cotarcă, Elena Ciurariu, Laura Marusciac, Sabine Groza, Marius Georgescu, Luminita Cernescu, Crenguța Calma, Adriana			

Gherbon. Human physiology - practical papers - general physiology, digestive, blood, renal. Eurostampa Publishing House, Timisoara, 2017

Optional bibliography:

1. G. Mihalaş, S. R. Goţia, R. Mateescu, C. Bunu, C. Mederle, P. Ştefăniţă, L. Noveanu, D. Cocârlă, I.R. Siska, G. Tănăsie, D. Crîşnic, C. Tatu, O. Coste, C. Uram-Țuculescu, E. Suciuc, D.C. Nistor. Practical works of physiology. Functional exploration of apparatus and systems. LITO UMFT, 2000.
2. Ioana-Raluca Siska, Carmen Bunu, Physiology Laboratory Manual. Ed. Orizonturi Universitare, Timisoara, 1999.

9. Correlation of subject content with the expectations of representatives of the epistemic communities, professional associations and representative employers in the field related to the programme

- The optional course proposed to be taken in the second year of study will prepare students to understand the concepts taught in the pathophysiology and semiology disciplines they will study in the third year and will ground the knowledge of the integrated regulatory mechanisms required for all clinical disciplines from the third to the sixth year.
- Preparing students for the application of personalised medicine requires a thorough knowledge of the pathophysiological mechanisms underlying disease endotypes so that an integrative understanding of the mechanisms regulating physiological processes is required.
- The knowledge, practical skills and attitudes learned in this discipline provide the basis of study and the foundation for understanding and learning any preventive, diagnostic, curative or restorative medical act required in clinical practice.
- The discipline aims to provide students with optimal prerequisites for the following years of study, with a view to successful employment, immediately after graduation, in residency programmes in Romania and other EU countries.











10. Evaluation

Type of activity	10.1 Evaluation criteria	10.2 Evaluation methods	10.3 Weight of final mark
10.4 Course	<p>Knowledge for grade 5:</p> <ul style="list-style-type: none"> - Definition of the phenomenon; - Integrative physiological mechanism of production of the phenomenon; - Physiological limits of the phenomenon. <p>Knowledge for the grade 10:</p> <ul style="list-style-type: none"> - Graphs relevant to the physiological phenomenon; - Integrative control mechanisms for major appliances and systems; - Physiological and pathological variations in functional parameters; - Mechanisms for adapting to demands; - Integration of physiological phenomena into the general functions of the body. 	Final assessment - 50 multiple choice tests	50%
10.5 Laboratory	<p>Knowledge for grade 5:</p> <ul style="list-style-type: none"> - Principle of the method; - Description of the practical methodology; - Normal values. <p>Knowledge for a grade 10:</p> <ul style="list-style-type: none"> - Principle of the method; 	Final evaluation - interpretation of parameters generated from functional explorations	50%

	<ul style="list-style-type: none"> - Learning practical methodology; - Normal values; - Physiological and pathological variations; - Interpretation of some bulletins - Clinical importance. 		
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10.6 Minimum performance standard

- Passing the exam in the course subject: students must obtain a minimum mark of 5, i.e. 60% of the maximum marks.
- Passing the practical exam: students must obtain a minimum grade of 5.

Date of completion	<p>Signature of course holder</p> <p>1. Prof. Dr. Carmen Panaitescu</p>  <p>2. S.I. Dr. Haidar Laura</p>  <p>3. Ş.I. Dr. Georgescu Marius</p>  <p>4. Ş.I. Dr. Raul Pătraşcu</p> 	<p>Signature of laboratory/internship holder</p> <p>1. Asst. Dr. Goţia Laura</p>  <p>2. Asst. Dr. Calma Crenguţa</p>  <p>3. Asst. Drd. Bolocan Alexandru</p>  <p>4. Asst. Drd. Zimbru Răzvan</p>  <p>5. Asst. Drd. Alexandru Tirziu</p> 
<p>Signature of the discipline coordinator</p> <p>Prof. Dr. Carmen Panaitescu</p> 		
<p>Date of signature in the department</p>	<p>Signature of the Head of Department</p> <p>Prof. Dr. Virgil Păunescu</p> 