POLI ESCOLA SUPERIOR EDUCAÇÃO COMUNICAÇÃO DESPORTO TÉCNICO GUARDA	**SUBJECT DESCRIPTION**	**MODELO** PED.012.03

Course	**Degree in Sports**					
Subject	**Exercise Physiology II**					
Academic year	2023-2024	*Curricular year*	2nd	*Study period*	2nd semester	
Type of subject	Compulsory	*Student workload (H)*	Total: 108	Contact: 52,5	*ECTS*	4
Professor(s)	Faber Martins, Raul Bartolomeu					
☒ *Area/Group Coordinator* ☐ *Head of Department* *(select)*	Carolina Vila chã					

PLANNED SUBJECT DESCRIPTION

1. LEARNING OBJECTIVES

At the end of the subject the student must be able to:
1. Describe and interpret the structures and function of cardiovascular and respiratory systems;
2. Understand the regulation and control mechanisms of the cardiorespiratory function during exercise;
3. Know how to apply methodologies to assess the cardiorespiratory function at rest and during exercise;
4. Understand the experimental protocols to assess aerobic capacity and aerobic power;

Know the physiological responses to exercise in extreme environments and its effects on subject's health and performance

2. PROGRAMME

A. Introduction to Exercise Physiology
- Basic framework (concepts, physiology areas);
- Physiology of exercise (aim, homeostasis, acute response, chronic response);
- Historical perspective (precursors, Harvard Fatigue Laboratory, history evolution);
- Experimental criteria (lab vs field, ergometers, study design, control groups, graphic interpretation).

B. Cardiovascular System
- Heart (dimensions, localization, cavities, flow, systemic and pulmonary circulation);
- Myocardium (intrinsic and extrinsic control, electrocardiogram, heart rate, cardiac arrhythmias);
- Cardiac function (cardiac cycle, stroke volume, ejection fraction, cardiac output);
- Vascular system (blood vessels, blood pressure, hemodynamic factors, blood distribution, venous return);
- Blood (function, composition, red blood cells, viscosity);

C. Respiratory System
- Airways (nasal cavity, pharynx, larynx, trachea, bronchi, lungs);
- Pulmonary ventilation (inspiration, expiration, spirometry, pulmonary volumes);
- Pulmonary diffusion (respiratory membrane, partial pressure of gases, gas exchange in alveoli);
- Transport of gases through blood (oxygen transport, haemoglobin saturation, determinant factors, carbon dioxide transportation);
- Gas exchange at muscles (arterial-venous oxygen difference, myoglobin, carbon dioxide removal);
- Regulation of pulmonary ventilation (high centres, central and peripheral chemoreceptors);

D. Cardiovascular adaptations to acute exercise
- Heart rate (pre exercise heart rate, maximal heart rate, steady-state heart rate, Fick equation);
- Stroke volume (pre-load and after-load, Frank-Starling mechanism);
- Cardiac output;
- Blood pressure (systolic and diastolic);
- Blood flow (blood distribution during exercise);
- Blood (oxygen content, plasma volume, hemoconcentration),

E. Respiratory adaptations to acute exercise
- Pulmonary ventilation during exercise;

- Breathing irregularities during exercise (hyperventilation, dyspnea, Vasalva manouver);
- Ventilation and energy metabolism (ventilatory equivalents for oxygen, ventilator threshold);
- Respiratory limitations to performance (maximal voluntary ventilation, respiratory disorders);
- Respiratory contribution for acid-based balance

F. Cardiorespiratory adaptations to aerobic training

- Cardiorespiratory endurance ($VO2_{max}$, aerobic power, sub-maximal effort effects);
- Cardiovascular adaptations (heart size, stroke volume, heart rate, cardiac output, blood pressure and blood flow);
- Respiratory adaptations (pulmonary ventilation, pulmonary diffusion, muscle adaptations);
- Metabolic adaptations (anaerobic threshold, respiratory exchange ratio, oxygen consumption);
- External factors (training status, heredity, sex);

G. Exercise in hot and cold environments

- Body temperature regulation;
- Physiological responses to exercise in the heat and cold;
- Health risks during exercise in the heat and cold;
- Acclimation during exercise in the heat;

H. Exercise at altitude

- Environmental conditions at altitude;
- Physiological responses to acute altitude exposure ;
- Exercise and sport performance at altitude;
- Acclimation chronic exposure to altitude;
- Health risks to acute exposure to altitude.

I. Laboratory course

- Cardiovascular assessment (heart rate and blood pressure);
- Respiratory assessment (gas exchange);
- Aerobic capacity assessment (anaerobic threshold);
- Aerobic power assessment ($VO2_{máx}$);

3. COHERENCE BETWEEN PROGRAMME AND OBJECTIVES

The contents A “Introduction to Exercise Physiology”, B “Cardiovascular system” and C “Respiratory system” are related with the skill 1 “Describe and interpret the structures and function of cardiovascular and respiratory systems”. The contents D “Cardiovascular adaptations to acute exercise”, E “Respiratory adaptations to acute exercise” and F “Cardiorespiratory adaptations to aerobic training” are related with the skill 2 “Understand the regulation and control mechanisms of the cardiorespiratory function during exercise”. The contents G “Exercise in hot and cold environments” and H “Exercise at altitude” are related with the content 5 “Know the physiological responses to exercise in extreme environments and its effects on subject’s health and performance”. The content I “Laboratorial course” is related with the content 3 “Know how to apply methodologies to assess the cardiorespiratory function at rest and during exercise” and 4 “Understand the experimental protocols to assess aerobic capacity and aerobic power

4. MAIN BIBLIOGRAPHY

Billat, V. (2002). Fisiología y metodología del entrenamiento. 1ª edicion, Paidotribo, Barcelona.
Costa, M.J. (2015). Fisiologia do exercício físico II: manual de estudos práticos. 1ª edição, Edições Politécnico da Guarda, Guarda.
Espanha, M., Silva, P., Pascoal, A., Correia, P., Oliveira, R. (2012). Anatomofisiologia - Tomo III. Funções da Vida Orgânica Interna. Edições FMH, Lisboa.
Haf, G.G., Dumke, C. (2018). Laboratory manual for exercise physiology. 2nd edition, Human Kinetics.
Kenney, W.L., Wilmore, J.H., Costill, D.L. (2019). Physiology of Sport and Exercise. 75th edition. Human Kinetics.
Mcardle, W.D., Katch, F.I., Katch, V.I. (2014). Exercise Physiology: energy, nutrition, and human performance. 8th edition. Lippincott Williams & Wilkins, Philadelphia.
Powers, S.K., Howley, E.T. (2017). Fisiologia do Exercício: teoria e aplicação ao condicionamento e ao desempenho. 9ª edição. Manole.
Tanner, R.K.; Gore, C.J. (2013). Physiological tests for elite athletes. Australian Institute of Sport. 2nd edition, Human Kinetics.
Selley, R.R. (2016). Anatomia e Fisiologia de Seeley. Mcgraw-Hill

5. TEACHING METHODOLOGIES (INCLUDING EVALUATION)

Teaching Methodologies

The. Theoretical classes: allow the assimilation of the theoretical bases underlying the physiology of exercise.
Theoretical-practical classes: provide students with practical experiences in the scope of the analysis and study of physiological phenomena.
Laboratory practice classes: develop skills to implement methodologies for physiological assessment and determination of responses to physical exercise.
Tutorial guidance sessions: guide students in the various tasks inherent to the requested activities.

Evaluation Rules

The evaluation process will be carried out in accordance with the "Regulation of the Student Attendance and Evaluation Regime". The frequency assessment shall focus on the performance of students in the following components/tests:
• Theoretical Assessments (3) - 90% (**minimum grade in each test cannot be less than 8.0 values**);
• Practical Assessment (1) - 10% (performing laboratory works)
If final grade, **of the students who obtained the minimum grade of the theoretical evaluations**, referring to the final average is not reached (9.5 values) the student will be admitted to the exam, whose final grade weighting is 100%

6.COHERENCE BETWEEN TEACHING METHODOLOGIES AND OBJECTIVES

Teaching methods will be selected to maximize the acquisition of skills defined: 1. Lectures using multimedia apparatus. This methodology will be used to present fundamental contents related to all the skills selected. 2. Consolidation of the skills acquired during lectures during the theoretical-practical classes and lab classes fulfilling work sheets and reports. This methodology will be used to consolidate all the contents related to all the skills selected. At the same time it is done tutorial orientation. 3. Conduct Lab Works to develop and consolidate skills related to the skill “Laboratory course”.

7.ATTENDANCE

According to the regime applied at ESECD.

8. CONTACTS AND OFFICE HOURS

fabermartins@ipg.pt – Monday: 10:30-17:00; Tuesday: 15:00-18:00; Raul Bartolomeu (laboratório) - Tuesday 14:00 as 18:00; Wednesday 14:00 as 18:00

DATE

19 de fevereiro de 2024

Professor

Area /Group Coordinator

(signature)