Guía Docente 2018/2019

Scientific Principles of Strength and Conditioning

Bases de la Fuerza y el Acondicionamiento Físico

Master's in High Performance Sport: Strength and Conditioning

Mode: Semi-presencial

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Scientific Principles of Strength and Conditioning

Module: **III**.

Subject matter: **Scientific Principles of Strength and Conditioning.**

Requisite: **Mandatory.**

Nº of credits: **4.5.**

Academic term: **1st semester**

Professors: **Dr. Filipe Conceiçao, Dr. Pedro E. Alcaraz, Dr. David García López, Dr. Nicola Maffiuletti and D. Tomás Freitas**

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Office hours: **by appointment via email**

Coordinator: **D. Jorge Carlos Vivas.**

Brief Description

This course will address the general and specific principles related to contractile force production. Specifically, mechanisms involved in force production will be examined at both the macro and micro levels. The contents that will be discussed are neural and mechanical mechanisms involved in force production, as well as their specific assessment through innovative and gold standard techniques. In addition, special attention will be focused on the specific responses and adaptations in force production by different strength training protocols, as well as the relationship of these mechanisms with high-performance sport.

Breve descripción del módulo

Esta asignatura abordará los principios generales y específicos relacionados con la producción fuerza contráctil. De manera específica se examinarán desde una perspectiva tanto macro como micro, todos aquellos mecanismos involucrados en la producción de fuerza. Los contenidos a tratar son los mecanismos nerviosos y mecánicos involucrados en la producción de fuerza, así como la valoración específica de los mismos a través de técnicas novedosas y actuales. Además, se prestará especial atención, a las respuestas y adaptaciones específicas de dichos mecanismos producidas por diferentes entrenamientos de fuerza, así como a la relación de los mismos con el alto rendimiento deportivo.

Pre-requisites

None.

Objectives

1. To know the basic and advanced principles underlying the foundations of contractile force production in its different manifestations.
2. To address the various methodological tools for measuring different manifestations of strength and deepen the knowledge of new assessment systems.
3. To know the adaptations and responses to specific strength training programs.

Competencies and Learning Outcomes

MECES1: Students will know how to apply the acquired knowledge and have the capacity to problem solve in new or unfamiliar settings within broader (or multidisciplinary) contexts related to their field of study.

MECES2: Students will be able to integrate knowledge and handle the complexity of formulating judgment based on information that may be incomplete or limited, including reflections on social and ethical responsibilities linked to the application of their knowledge and judgment.

MECES3: Students will know how to communicate their conclusions (and the knowledge and rationale underpinning them) to the public (specialists and non-specialists) in a clear and unambiguous manner.

MECES4: Students will possess learning skills that will allow them to continue studying in a way that is largely self-directed or autonomous.

MECES5: To have and understand knowledge that will provide them the foundation or opportunity to be original in the development and/or application of ideas, often within the research context.

G1: To acquire skills through the teaching-learning process that allows them to continue learning in the field of sports training and conditioning not only with established contacts with Master's Degree professors and professionals but also autonomously.

G2: To acquire and to consolidate the initiative, the entrepreneurial spirit to start up projects related to sports training and conditioning.

T1: Capacity for analysis and synthesis.

T2: Capacity for organization and planning.

T4: Decision making.

T5. Teamwork.

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T7. Capable of interpersonal relationships

T8: Critical Thinking.

T9. Ethical commitment.

T10: Study autonomously.

T11: Adapting to new situations.

T15: Reflectivity

T16: Problem-solving.

U1: Consider the principles of Christian humanism as core values in the development of professional practice.

U2: Being able to project the acquired knowledge and skills to promote a society based on the values of freedom, justice, equality and pluralism.

S5: To know the specific and practical fundamentals of metabolism in training and high level competition and its evaluation using scientific rigor.

S10: To know the function of various systems and structures limiting the physiological performance and its evaluation using scientific rigor.

E4: To be able to apply the physiological, biomechanical, behavioral and social principles as the research object.

E9: To identify different methods for evaluating both performance and health in the field of Performance and Conditioning.

E13: Being able to identify the physiological and metabolic changes that occur with interventions in the area of Sport Performance and Conditioning.

C2: Being able to apply technology of information and communication (TIC) in an advanced manner in Sport Performance and Conditioning.

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Methodology

Methodology	Hours	Work hours Required attendance	Work hours no attendance
Theoretical exposition	11.25	22.5 hours (20 %)	
Discussion groups, seminars	4.5		
Evaluation	2.25		
Tutorial	4.5		
Personal study	45		90 hours (80 %)
Preparation of work and exposition	27		
Analysis of scientific articles	9		
Literature searches	9		
TOTAL	112.5	22.5	90

Syllabus

Theoretical Teaching Program

Topic 1. Neural mechanisms involved in strength and power; selective motor unit recruitment; rate of onset of electromyographic activity; increase of firing frequency, increase of total recruitment.

Topic 2. Muscle mechanics involved in strength and power; muscle hypertrophy, muscle fiber types; muscle protein expression.

Topic 3. Musculoskeletal stiffness and its relationship to performance on tests of strength and power.

Topic 4. Assessment of strength and muscle architecture. New methods for assessing fatigue.

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Practical teaching program

Seminar 1. Study of muscle architecture by ultrasound.

Seminar 2. Assessment of stiffness through direct and indirect methods.

Relationship with other subjects of the curriculum

This material is related to: Exercise Physiology, Strength Training and Conditioning in the Elderly, Planning and Program design of Resistance Training and Conditioning.

Evaluation System

February/June/September Call:

The evaluation system of the acquisition of learning outcomes of each of the modules' compulsory subjects will be based, in general, with the following grade distribution:

-20% for written tests, in which evaluate the topic contents presented through theoretical-practical presentation, reading and analysis of documents provided in the module.

-20% for assessment on workshops, presentations and classroom discussions.

-60% for assessment of dynamic course work developed in seminars and workshops

The weighting range established in the evaluation system is 5%, and it will be determined based on the type of evaluations given in the module.

The module will have 2 calls for turning in assigned work: a regular call (set at the end of the module) and an extraordinary call (set prior to the first call the final Master's Thesis work).

The scoring system will be as follows, set by R.D. 1.125/2003 of September 5th: Fail: 0-4,9; Pass: 5-6,9; Notable: 7-8,9; Outstanding: 9-10. The honorable mention of Distinction (Matrícula de honor) will be awarded by the professor to the student. Based on the number of students enrolled, only 5% will be eligible for this honorable mention, except for when the enrollment is under 20 in which case only one student will be granted this honor.

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To have a passing grade for this module, one must obtain at least half of the total score for each of the instruments of evaluation.

Bibliography

Basic Bibliography

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- González-Badillo JJ, Ribas-Serna J (2002). Bases de la Programación del entrenamiento de fuerza. Barcelona. Inde.
- Maud PJ. , Foster C. (2006). *Physiological assessment of human fitness*. United States: Human Kinetics. Second Edition.

Complementary bibliography

- Alegre, L.M., Gonzalo-Orden, J.M., Aguado, X. (2001). Arquitectura muscular: métodos de estudio y estado actual de conocimientos. *Revista de entrenamiento deportivo*, Tomo 15, Nº. 4: 5-12
- Alegre, L.M., Gonzalo-Orden, J.M., López, C., Aguado, X. (2002). Repercusiones de la arquitectura del músculo en la manifestación de la fuerza. *Revista de entrenamiento deportivo,* Tomo 16, Nº. 2: 15-20.
- Fernández del Olmo M, Reimunde P, Viana O & Martín Acero R. (2006). Nuevas aproximaciones a las adaptaciones nerviosas inducidas por el entrenamiento de fuerza. Revista de Entrenamiento Deportivo nº1 Tomo XX, 37-40.
- LeSuer DA, McCormick JH, Mayhew Jl, Wasserstein RL, Arnold M (1997). The accuracy of prediction equations for estimating 1-rm performance in the bench press, squat, and deadlift. The Journal of Strength and Conditioning Research 11(4): 211-213.
- Marquez G, Alegre LM, Aguado X, Fernandez-del-Olmo M (2013). Neuromechanical adaptation induced by jumping on an elastic surface. Journal of Electromyography and Kinesiology. 23: 62-69.
- Reimunde P, Fernández del Olmo M, Martín Acero R (2006) Neurofisiología de la producción voluntaria de fuerza muscular contráctil y sus mecanismos de adaptación (1). Revista de Entrenamiento Deportivo nº4 Tomo XX, 21-29.
- Shield A, Zhou S. (2004) Assessing voluntary muscle activation with the twitch interpolation technique. Sports Med. 34(4):253-67.
- Zatsiorsky VM. (1995). Science and practice of strength training. Champaign (IL): Human Kinetics.

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Related websites

Facultad de Ciencias de la Actividad Física y del Deporte de la UCAM

http://www.ucam.edu/estudios/grados/cafd

CCD - Cultura, Ciencia y Deporte. Revista del Departamento de Ciencias de la Actividad Física y del Deporte.

http://www.ucam.edu/ccd

Master's in High Performance Sport: Strength and Conditioning (UCAM)

http://www.ucam.edu/estudios/postgrados/high-performance-semipresencial

Other resources on Physical Activity and Sport

http://www.sportsci.org/

http://www.nsca-lift.org/

http://www.cafyd.com/index2.html

Study tips

- Pay attention to what the professor has to share with you at the start of the course. The professor will present the syllabus, bibliography and assignments, methodological approaches to follow, as well as other relevant material of interest that will help the learning process of the subject.
- Attend classes and actively participate in the classroom
- Orient the effort and study on the argumentative reasoning of the course contents.
- Previous reading of documentation provided prior to the start of class.
- Complete and turn-in assignments by scheduled deadlines.
- Stay current on study materials, as new knowledge and new tasks are built upon work presented on previous weeks
- Refer to recommended literature for each topic and do not limit yourself to solely studying off of notes taken in class.
- Utilize office hours, Campus Virtual or email of the professor to help clarify or resolve any questions or doubts you may have regarding the course or course material.

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- Attend at least one personal tutoring session to assist in completing work(s) assigned and to become more familiar with the content.

Educational materials

To be specified by the professor as required by the subject.

Educational materials used in the course to facilitate the acquisition of skills are:

- PowerPoint presentations that professors' use will serve as an outline or guide of the content presented in class (and not as detailed notes on the subject). Students will make their own notes using all the educational materials described herein.
- Scientific articles, shared through Campus Virtual, will be related to specific content taught in class. Forum and social networks (Twitter) will be used to raise questions that would require some critical thought and to provide practical application for each article.
- Supporting documents will be shared also through Campus Virtual or will be sought by students through information technology and communication. These documents should also be related to specific content presented in class.
- Conceptual maps and discussion reports for each one of the content topics.

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