Course Title	**Biochemistry of Exercise and Sports**				
Course Code	ABS311				
Course Type	Elective				
Level	BSc (Level 1)				
Year / Semester	3rd /6th Semester				
Teacher's Name	Dr Elena Papacosta				
ECTS	6	Lectures / week	2	Laboratories/week	2
Course Purpose	The course aims to extend the knowledge and understanding about the biochemical, physiological and molecular changes that occur as a result of exercise and sports training. Students will be engaged in applied laboratory direct and indirect testing techniques, that assess the metabolism of cardiorespiratory capacity and muscle function and understand and interpret the results according to the current literature for health optimization and maximization of sport performance.				
Learning Outcomes	By the end of this course, the students should be able to: 1. Measure, record and explain the appropriate units of measurement for the parameters being assessed. 2. To describe the procedure for a valid laboratory and outdoor ergometric exercise and define the relevant monitoring parameters. 3. Understand the biochemical events that occur as a result of exercise during different and varied exercise conditions. Including the integrated physiological and molecular adaptations of training and the interpretation of such events via direct and indirect exercise techniques 4. Understand the scientific literature relevant to exercise metabolism. 5. Exhibit a satisfactory level of competency in administering practical exercise and metabolic exercise testing. 6. Collect and analyse biochemical markers in urine, blood and saliva before, during and after exercise protocols. 7. Interpret the results of biochemical analysis for providing guidelines for the development of sport and fitness training programs				
Prerequisites	-	Corequisites	-		
Course Content	<u>Theory:</u> Physiological adaptations during exercise: Acute and chronic adaptations, Principles of metabolism during exercise, Neuromuscular function and exercise, Respiratory function and exercise, Cardiovascular function and exercise, Hormonal function and exercise. Exercise and Sports Training and metabolic adaptations: Aerobic training adaptations, aerobic system training, anaerobic training adaptations. Neuromuscular function and exercise: Neuromuscular control of movement, Neuromuscular adaptations with resistance training. Carbohydrate metabolism during exercise: glycogen and glucose metabolism during exercise, insulin-dependent and non-insulin-dependent				

	glucose entry into cells, aerobic and anaerobic glycolysis and ATP, lactic acid production and anaerobic carbohydrate metabolism, gluconeogenesis, Cori's cycle, lactate accumulation and removal during and after exercise. Lipid metabolism during exercise: lipid metabolism and energy production during exercise, changes in plasma fatty acid concentration during exercise, recruitment of energy substrates during exercise of different duration and intensity, effect of exercise on plasma triacylglycerols and cholesterol. Protein metabolism and exercise: Proteins, amino acids and their function in sport and exercise, myoglobin, haemoglobin and their properties, effect of acute exercise and training on amino acid metabolism, restoration of muscle energy sources after exercise. Biochemistry of the neuromuscular processes of movement: Nerve impulse, resting potential and action potential, muscle contraction, actin, myosin and mechanism of contraction force production Biochemistry of muscle injury and muscle repair after exercise: exercise-induced muscle injury and inflammation, immune system cell mobilization in exercise and sport training, muscle tissue catabolism and exercise, importance of exercise and nutrition in muscle remodelling. <u>Laboratory experiments/exercises:</u> As part of the course, laboratory exercises are carried out on the course material for a better deepening and consolidation of the theoretical part. Indicative exercises are: Collection and analysis of urine, blood and saliva during exercise, spirometry and ergo-spirometry protocols, maximal and submaximal testing of sport performance, lactate kinetics during exercise and anaerobic threshold, collection techniques for physiological parameters including blood pressure, respiratory gas analysis, heart rate and ECG.
Teaching Methodology	Teaching methodology includes lectures on the theoretical background and laboratory exercises / experiments to better understand concepts of Biochemistry. Detailed lecture notes are presented with image-rich material and short animations are given to help describe/demonstrate several biochemical processes. Students are also introduced to specific databases such as pubmed, Ensembl, etc. During lecture, discussions are carried out and students are encouraged to answer questions and draw their own conclusions. Small exercises are sometimes given, to ticker critical thinking. As part of the developing students' skills, laboratory exercises are carried out by the students themselves in the Laboratory of Sport and Exercise Science with the proper laboratory equipment and under the supervision of teaching personnel. Appropriate preparation and demonstration by the laboratory personnel precedes each laboratory exercise. Assessment of laboratory includes the evaluation of lab reports submitted by each student after each laboratory exercise.
Bibliography	(a) <u>Textbooks</u>: Mougios, V. (2006) *Exercise Biochemistry*. Matz. K., Ed., Human Kinetics, Champaign, Illinois, 332 Willmore J and DL Costill (2005) *Physiology of sport and exercise.* P.Ch. Pasxalidis Editions, Athens.

	(b) References: Klisouras V. (2004). *Ergophysiology.* P.Ch. Pasxalidis Editions, Athens. Powers S. & Howley E. (2007). *Exercise Physiology: Theory and Application to Fitness and Performance.* McGraw Hill, UK. American College of Sports Medicine (2014) *ACSM's guidelines for exercise testing and prescription (9th Ed.)*. Wolters Kluwer Health, Lippincott Williams and Wilkins.
Assessment	For student evaluation, the overall grade is determined by a written midterm exam (20%), a laboratory grade (20%) and a written final exam (60%). The mid-term exam is carried out between the 6th and 8th week and it mainly includes short answer questions and problem- solving questions to examine specific modules of the course. The laboratory grade is based on the evaluation of the laboratory reports (60% of the laboratory grade) provided by the students for each experiment, and a final laboratory examination (40% of the laboratory grade) which mainly includes short answer questions and problem-solving questions. In the laboratory reports, students are asked to describe the experiment procedure, to evaluate and analyse their results and to answer specific questions. The following criteria are taken into account when evaluating laboratory reports: (a) experimental data collection (30%), (b) data analysis (40%), and application of theory to draw conclusions (30%). The final exam of the course is carried out during the 14th-16th week of each semester and includes short answer questions, decision questions, and problem-solving questions regarding all course modules. The final assessment of the students is formative and summative and is assured to comply with the subject's expected learning outcomes and the quality of the course.
Language	Greek, English