

## **KIN 155 - Exercise Physiology**

### Course Description

Exercise physiology examines the physiological responses and adaptations of the human organism to physical activity. Considerable emphasis is given toward understanding how the body functions during exercise and adapts to long-term training. Topics related to neuromuscular physiology, bioenergetics, cardiorespiratory physiology, circulation, neuroendocrinology, and cellular developmental traits will be presented and interrelated. In addition, the physiological effects of factors such as age, gender, body composition, and the environment on human performance will be discussed. Lectures and discussions will focus on applying the information from these topics into a framework for conditioning programs designed to improve performance and promote health enhancement.

### Prerequisites

KIN 70 - Introduction to Kinesiology, BIOL 66 - Human Physiology, CHEM 30A - Introductory Chemistry or higher level chemistry course, and a general education mathematics course (Area B4), or equivalents.

### Undergraduate Degree Program Learning Outcomes (PLO)

At the end of a Bachelor of Science degree program in the Department of Kinesiology students should be able to:

1. obtain a critical understanding and the ability to apply theoretical and scientific knowledge from the subdisciplines in kinesiology for personal fitness, healthy lifestyles, sport, and/or therapeutic rehabilitation.
2. effectively communicate the essential theories, scientific applications, and ethical considerations related to kinesiology.
3. apply scholarship and practice of different movement forms to enhance movement competence in kinesiology.
4. recognize and apply sustainable approaches as they relate to kinesiology.
5. identify social justice and equity issues related to kinesiology for various populations.

### Course Objectives

Following successful completion of this course, students will be able to:

1. identify and explain the basic physiological responses and training adaptations to physical activity (PLO #1 and #3).
2. analyze and identify the physiological requirements of sports and physical activities (PLO #1 and #3).
3. identify and explain various physiological factors limiting performance of various sports and physical activities (PLO #1 and #3).
4. sensitively identify and explain age, gender, cultural, and other individual differences that may exist in physiological responses, training adaptations, and performance capabilities in various sports and physical activities (PLO #1 and #5).
5. identify and explain the basic components of conditioning programs designed to improve performance and promote health enhancement (PLO #1 and #3).
6. identify and describe equipment used to measure and evaluate various physiological aspects of human performance (PLO #1 and #3).
7. collect, analyze, and interpret physiological data collected from various laboratory tests and procedures (PLO #1, #2, and #4).

## Requirements

### 1. Course Reader and Calculator.

Cisar, C.J., Thorland, W.J., & Christensen, C.L. (2013). Physiology of exercise notebook. San Jose, CA: Maple Press (available at Maple Press, 481 East San Carlos Street).

Battery operated hand calculator (**no cell phones**).

2. Students are responsible for information presented in lectures and laboratory sessions, whether present or not. In addition, students are responsible for material presented in the assigned readings.
3. Active participation in the laboratory sessions is expected. Laboratory sessions are designed to supplement the lecture material. Laboratory sessions will consist of data collection, data analysis, and discussion of the results obtained during the laboratory sessions. Students are expected to study the data collected and answer questions during and at the end of each lab. This material will then be covered on lab exams.
4. Lecture examinations will cover lecture materials and related assigned readings. Laboratory examinations will cover the conceptual and technical aspects of the material presented in the laboratory sessions and related laboratory materials. All examinations will be conducted as closed textbook and notebook. Both the lecture and laboratory examinations will be objective examinations consisting of multiple choice, matching, and/or true-false questions; the examinations may involve calculations. **EXAMINATIONS WILL BE GIVEN AT THE SCHEDULED TIME ONLY AND NO MAKE-UP EXAMINATIONS WILL BE GIVEN**, except for dire and serious illnesses. If this should occur, the instructor must be notified personally PRIOR to the examination. Students should be aware that more than a superficial understanding of concepts will be necessary in order to apply the information given in class and related readings to situations presented in examination questions.
5. Students will have the opportunity to earn additional points through participation in laboratory activities and completion of laboratory assignments. The maximum additional points that can be earned are 5 points. Laboratory assignments will not be accepted late.
6. ACADEMIC INTEGRITY (from Office of Judicial Affairs). "Your own commitment to learning, as evidenced by your enrollment at San Jose State University, and the University's Academic Integrity Policy requires you to be honest in all your academic course work. Faculty are required to report all infractions to the office of Judicial Affairs. The policy on academic integrity can be found at <http://www2.sjsu.edu/senate/S04-12.htm>.
7. AMERICANS WITH DISABILITIES ACT COMPLIANCE. "If you need course adaptations or accommodations because of a disability, or if you need special arrangements in case the building must be evacuated, please make an appointment with The Disability Resource Center (924-6000, located in Adm 110) as soon as possible. Presidential Directive 97-03 requires that students with disabilities register with DRC to establish a record of their disability."

## Grading Requirements

Grades will be based solely on accumulated points from the examinations and application paper with total points allocated in the following manner.

	<u>Points</u>
Two Lecture Examinations - 30 Points Each (PLO #1, #3, #4, and #5)	60
Two Lab Examinations - 20 Points Each (PLO #1, #3, #4, and #5)	<u>40</u>
Subtotal	100
Laboratory Participation and Assignments (PLO #1, #2, #4, and #5)	<u>5</u>
Total	105

Final grades will be assigned according to the following allocation of total points.

A+	98-105	B+	88-89	C+	78-79	D+	68-69	F	≤ 59
A	92-97	B	82-87	C	72-77	D	62-67		
A-	90-91	B-	80-81	C-	70-71	D-	60-61		

## Tentative Schedule of Lecture Topics and Examinations

### Introduction

Central and Peripheral Nervous System Control of Movement

Contractile Model

Muscle Fiber Type Variations and Properties

Three Basic Principles of Exercise Physiology

Motor Unit Response Characteristics

Determinants of Force Production

Influences on Speed of Movement

Effects of Muscular Fatigue on Force Production and Training Influences on Contractile-Related Factors

Phosphagen Metabolism and Glycolytic Metabolism

Oxidative Metabolism - Krebs Cycle and Electron Transport System

Energy System Characteristics and Energy Yield from Carbohydrate and Fat Metabolism

Beta Oxidation of Fatty Acids

Metabolic Response to Exercise

Free Fatty Acid Mobilization

Carbohydrate Loading and Replenishment Fluids and Other Ergogenic Aids

Muscle Histological and Biochemical Adaptations from Training

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First Lecture Examination – Wednesday, October 16th

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Pulmonary, Metabolic, Cardiac, and Motor Unit Recruitment Responses to Exercise

Effects of Respiratory Rate and Depth on Alveolar Ventilation Rate

Gas Exchange and Pulmonary Diffusion

Plasma and Hemoglobin Transport of Oxygen

Hemoglobin-Oxygen Dissociation Curve

Circulatory and Cardiac Responses to Exercise

Submaximal and Maximal Oxygen Uptake Rate

Influences on Cardiorespiratory Responses to Exercise

Carbon Dioxide Transport

Lactic Production and Buffering During Exercise

Anaerobic Threshold

Cardiorespiratory and Metabolic Training Adaptations

Review of Oxygen Uptake Rate Responses to Exercise

Influence of Exercise on Growth, Aging, Coronary Heart Disease, and Other Causes of Death

Fundamental Concepts Underlying Training Programs

Metabolic Contributions to Energy Requirements

Review of Oxygen Deficit and Debt Concepts

Effects of Different Pacing Strategies on Oxygen Uptake Rate and Oxygen Deficit

Factors Affecting Oxygen Debt and Rate of Recovery from Exercise

Performance and Training Implications

Interval Training Guidelines and Endurance Training Guidelines

Concepts Related to Strength Training, Strength Training Guidelines, and Muscle Soreness

Muscle Mass and Strength Development Trends

Review of Gender Differences in Age Trends of Body Composition

Review of Training Adaptations

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Second Lecture Examination – Friday, December 13th, 0715-0930

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## Tentative Laboratory Topics and Examinations

Week	Dates	Lab #	Topics/Examinations
1	8/21-22		No Lab
2	8/26-29	1	Characteristics of Muscular Strength and Contractile Responses: Electromyography Responses
3	9/2-5		Labor Day – No Lab
4	9/9-12	2	Characteristics of Muscular Strength and Contractile Responses: Isokinetic Responses
5	9/16-19	3	Anaerobic Work Indices
6	9/23-26	4	Determination of Resting Metabolic Rate by Open Circuit Calorimetry and Energy Expenditure
		6	Cardiorespiratory and Metabolic Responses During Submaximal Exercise and Recovery
7	9/30 10/1-3	5	Determination of Heart Rate and Blood Pressure Basic Interpretation of Electrocardiograms
8	10/7-11		First Lab Examination
9	10/14-17	7	Determination of Maximal Oxygen Uptake Rate and Anaerobic Threshold
10	10/21-24	8	Astrand-Rhyming Bicycle Ergometer Test and Other Field Tests for Determination of Maximal Oxygen Uptake Rate
11	10/28-31	9	Pulmonary Function Testing
12	11/4-7	10	Body Composition - Underwater Weighing
13	11/11-13		Veterans Day – No Lab Monday, Tuesday, and Wednesday
13	11/14	11	Anthropometric Determination of Body Composition (Thursday lab only)
14	11/18-20	11	Anthropometric Determination of Body Composition (Monday, Tuesday, and Wednesday labs)
14	11/21	12	Anthropometric Determination of Body Build Characteristics (Thursday lab only)
15	11/25-27	12	Anthropometric Determination of Body Build Characteristics (Monday, Tuesday, and Wednesday labs)
16	12/2-5		Second Lab Examination
17	12/9		No Lab