Department of Kinesiology
San Jose State University
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Fall, 2009

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, Bio 66 – Human Physiology, Chem 30A - Introductory Chemistry, and a general education mathematics course (Area B4), or equivalents.

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.
2. analyze and identify the physiological requirements of sports and physical activities.
3. identify and explain various physiological factors limiting performance of various sports and physical activities.
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.
5. identify and explain the basic components of conditioning programs designed to improve performance and promote health enhancement.
6. identify and describe equipment used to measure and evaluate various physiological aspects of human performance.
7. analyze and interpret physiological data collected from various laboratory tests and procedures.

Requirements

1. Textbooks and Course Materials

   Cisar, C.J., Thorland, W.J., & Christensen, C.L. (2007). Physiology of Exercise Notebook. San Jose, CA: Maple Press (available at Maple Press, 481 East San Carlos Street).
   Powers, S.K., & Howley, E.T. (2007). Exercise Physiology: Theory and Application to Fitness and Performance (7th ed.). McGraw Hill: New York, NY (available at Spartan Bookstore).
   Battery operated hand calculator.

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 (do not leave a note or message) 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 select one physical activity (e.g., aerobics, cycling, resistance training, running, swimming, water exercise, etc.), sport (e.g., tennis, volleyball, football, soccer, basketball, etc.), or health-related issue (e.g., coronary heart disease, diabetes, obesity, osteoporosis, etc.) on which to write a short application paper. In a clear, concise, and well-organized manner, students will write a short paper applying information presented in lectures, labs, and assigned readings to the chosen physical activity, sport, or health-related issue. In addition to using the textbook and class notes, minimum of three refereed publications (primary references) should be used as references. Citation of the actual data collected in research studies is desirable when appropriate. The paper should relate to at least one of the following topics: (1) neuromuscular physiology, (2) bioenergetics, (3) cardiorespiratory physiology, (4) circulatory physiology, (5) neuroendocrinology, or (6) body composition and build. Based on the nature of the physical activity, sport, or health-related issue chosen, inclusion of other topics in the paper may be appropriate. Inclusion of other topics in the paper should be pre-approved by the instructor. The paper should be typed, doubled spaced, **maximum three pages in length**, and written using the American Psychological Association format for citations and references. **The paper should be an original paper written exclusively for this class. The paper is due on or before Monday, November 23rd, 2009.**
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.

	Points
Two Lecture Examinations - 30 Points Each	60
Two Lab Examinations - 15 Points Each	30
Application Paper	10
Total	100

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

A+	98-100	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
Muscular Fatigue and Effects on Force Production
Influences on Speed of Movement
Training Influences on Contractile-Related Factors

Supplementary Readings from Textbook in Chapters 7, 8, 13, 19, and 21

Phosphagen Metabolism
Glycolytic Metabolism
Energy System Characteristics

Oxidative Metabolism - Krebs Cycle and Electron Transport System
Energy Yield from Carbohydrate and Fat Metabolism
Beta Oxidation of Fatty Acids
Glycerol Metabolism
Metabolic Response to Exercise
Free Fatty Acid Mobilization
Catecholamine Regulation of Glycogenolysis and Lipolysis
Carbohydrate Loading, Replenishment Fluids, Other Ergogenic Aids
Muscle Histological and Biochemical Adaptations from Training

Supplementary Readings from Textbook in Chapters 3, 4, 5, 13, 19, and 21

Tentative First Lecture Examination, Monday, October 12th

Pulmonary, Metabolic, Cardiac, and Motor Unit Recruitment Responses to Exercise
Effects of Respiratory Rate and Depth on Alveolar Ventilation Rate
Gas Exchange
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

Supplementary Readings from Textbook in Chapters 2, 9, 10, 11, 13, 19, 22, and 25

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 Uptake Rate Responses to Exercise
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
Endurance Training Guidelines
Concepts Related to Strength Training
Strength Training Guidelines
Muscle Soreness
Muscle Mass and Strength Development Trends
Review of Gender Differences in Age Trends of Body Composition
Review of Training Adaptations

Supplementary Readings from Textbook in Chapters 4, 6, 13, 14, 16, and 21

Second Lecture Examination
Wednesday, December 16th, 0715-0930

Tentative Laboratory Topics and Examinations

Week	Dates	Lab #	Topics/Examinations
1	8-24/26	1	Characteristics of Muscular Strength and Contractile Responses: Electromyography Responses

2	8-31/9-2	2	Characteristics of Muscular Strength and Contractile Responses: Isokinetic Responses
3	9-7		**No Lab or Lecture**
3/4	9-9/14	3	Anaerobic Work Indices
4/5	9-16/21	4 & 6	Determination of Resting Metabolic Rate and Energy Expenditure Metabolic Responses During Submaximal Exercise and Recovery
5/6	9-23/28	5	Determination of Heart Rate and Blood Pressure Basic Interpretation of Electrocardiograms
6/7	9-30/10-5		**First Lab Examination**
7/8	10-7/12	7	Determination of Maximal Oxygen Uptake Rate and Anaerobic Threshold
8	10-14	8	Astrand-Rhyming Bicycle Ergometer Test and Other Field Tests for Determination of Maximal Oxygen Uptake Rate
9	10-19		**No Lab or Lecture**
9	10-21	8	Astrand-Rhyming Bicycle Ergometer Test and Other Field Tests for Determination of Maximal Oxygen Uptake Rate
10	10-26/28	9	Pulmonary Function Testing
11	11-2/11-4	10	Body Composition - Underwater Weighing
12	11-9	11	Anthropometric Determination of Body Composition
12	11-11		**No Lab or Lecture**
13	11-16	11	Anthropometric Determination of Body Composition
14	11-23	12	Anthropometric Determination of Body Build Characteristic
14	11-25		**No Lab or Lecture**
15	11-30	12	Anthropometric Determination of Body Build Characteristic
15/16	12-2/7		**Second Lab Exam**