Department of Kinesiology

San José State University

KIN 154A
Instrumentation in Exercise Physiology & Biomechanics
Spring 2015

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Jim Kao office hours continued:
- Send email to reserve an appointment time

Other times available
- Send email to request a non-office hour appointment time

Class Days/Time	Sec 1 (Lecture) M 9:30 am - 10:20 am
	Sec 2 (Lab) MW 10:30 am - 12:20 pm
	Sec 3 (Lab) MW 12:30 pm - 2:20 pm
Classroom:	YUH 233 (exercise physiol half); YUH 233 & MQH 321 (biomech half)
Prerequisites:	KIN 70, 155, 158 with grades of C- or better; Human Anatomy & Physiology, Introductory Chemistry, GE Math

Course Description

This class is designed to assist the student in becoming familiar and proficient with the methods and instruments of assessing physiological and biomechanical characteristics of human performance.

Kinesiology Undergraduate Major Program Learning Objectives (KIN PLOs)

At the end of a Bachelor of Science degree program in the Department of Kinesiology, students should expect:

(1) to 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) to effectively communicate the essential theories, scientific applications, and ethical considerations related to kinesiology.
(3) to apply scholarship and practice of different movement forms to enhance movement competence in kinesiology.
(4) to recognize and apply sustainable approaches as they relate to kinesiology.
(5) to identify social justice and equity issues related to kinesiology for various populations.

Course-Specific Student Learning Outcomes (SLOs)

Upon successful completion of the course, students will:

Exercise Physiology

(1)   demonstrate knowledge of instruments and procedures used in physiological testing. (KIN PLO 2)
(2)   demonstrate proficiency in administering selected physiological tests. (KIN PLO 1)
(3)   interpret and explain test results. (KIN PLO 1, 2)
(4)   demonstrate knowledge of the underlying principles, benefits, and limitations of selected physiological tests. (KIN PLO 1, 5)
(5)   demonstrate sensitivity to age, gender, cultural, and other individual differences as they relate to the physiological assessment of human performance. (KIN PLO 1, 5)
(6)   demonstrate critical thinking and problem solving skills. (KIN PLO 1)

Biomechanics

(7)   demonstrate knowledge and use of equipment and procedures to collect acceleration data.
(8)   demonstrate proficiency in analyzing and interpreting acceleration data.
(9)   demonstrate knowledge and use of equipment and procedures to collect video/kinematic data.
(10)   demonstrate proficiency in analyzing and interpreting video/kinematic data.
(11)   utilize accelerometers, video cameras, and EMG equipment to analyze real-world movements (jumping, walking, running, stair climbing & descending, etc.) for effectiveness and efficiency.

Methods

(1)   Lecture/discussion
(2)   Demonstration
(3)   Observation
(4)   Assigned readings
(5)   Laboratory experience - emphasis on hands-on practice to develop competence

Course Content

(1)   Anthropometry & body composition
      (a)   Height, weight, circumferences, and bone diameters
      (b)   Bioelectrical impedance analysis (BIA)
      (c)   Skinfold measurements
      (d)   Hydrostatic weighing
      (e)   Air displacement plethysmography (Bod Pod)
      (f)   Dual-energy X-ray absorptiometry (DXA)
(2)   Pulmonary function
      (a)   Spirometry: static and dynamic lung volumes
      (b)   Environmental conditions
      (c)   Residual volume: measuring and estimating
(3)   Fitness & health assessments - Trifit system, Cholestech

(4)   Qualitative and quantitative movement analysis – video & acceleration data
(5)   Miscellaneous topics
        (a)   Equipment calibration and operation
        (b)   Selection of tests
        (c)   Equipment specifications
        (d)   Analysis and interpretation of results

Evaluation

The final course grade will be determined 50% from the exercise physiology unit and 50% from the biomechanics unit.

Calculating Grades

A+	97-100%	A	93-96%	A-	90-92%
B+	87-89%	B	83-86%	B-	80-82%
C+	77-79%	C	73-76%	C-	70-72%
D+	67-69%	D	63-66%	D-	60-62%
		F	<60%		

Requirements

- Consistent with SJSU guidelines, it is expected that students will spend a minimum of 45 hours for each unit of credit (normally three hours per unit per week), including preparing for class, participating in course activities, completing assignments, etc.

- Textbooks

Biomechanics

    e-textbook: Kao, J. C. (2014). Real-World Biomechanics (3rd Edition). Winchelsea, UK: PDF-Publishing, Drumlin Security Ltd.

    Chapter and Lecture Handouts: Available on my website

    Laboratory Handouts: Available on my website

Exercise Physiology

    Heyward, V. H., & Wagner, D. R. (2004). *Applied body composition assessment* (2nd ed.). Champaign, IL: Human Kinetics.

    Course reader — available from Maple Press

- Battery-operated calculator

Professionalism, Care of Equipment

This is a professional preparation course. Students are expected to:
- **Be fully prepared**; actively and enthusiastically participate in all laboratory sessions and class discussions.
- **Read assigned material and lab instructions BEFORE class.** (Lecture and lab time will be used to present material, help students master techniques, and check competencies. Students are directed to the green sheet and course reader for answers to many of their procedural questions.)
- Bring textbook, calculator, course reader, and other necessary supplies to class.
- Dress appropriately for scheduled activities.
- Participate in demonstrations and data collection.
- Enthusiastically serve as a client for others.
- PRACTICE, PRACTICE, PRACTICE techniques. *Use your class time effectively!* Ask for guidance from instructor if having difficulty mastering a technique.
- Complete competencies and assignments on time.
- Use equipment properly; clean and put away all equipment before leaving lab area.
- Keep lab clean. No food is allowed in the lab; covered drinks are permitted.

Students who consistently demonstrate professionalism, as described above, WILL be able to complete all lab assignments and competencies in a timely manner. Students who choose not to use laboratory time effectively may not complete all assignments, and should not expect the instructor to ensure that they do. **In an 8-week, lab-intensive class, if you fall behind it may be impossible to catch up.**

The most effective class results when EACH class member makes an INDIVIDUAL COMMITMENT to be an active participant in the teaching/learning process. Individual contributions and differing viewpoints will be appreciated and respected. Students are responsible for material presented and announcements made in each class. Students who miss class (a rare occurrence!) are responsible for obtaining material from another student BEFORE seeing the instructor about content missed.

University Policies

Academic Integrity
The University's Academic Integrity Policy is available at
http://www.sjsu.edu/studentconduct/docs/Academic_Integrity_Policy_S07-2.pdf.
Your own commitment to learning, as evidenced by your enrollment at San José State University and the University's integrity policy, require you to be honest in all your academic course work. Plagiarism and cheating are serious offenses. Faculty members are required to report all infractions to the Office of Student Conduct and Ethical Development, located at http://www.sjsu.edu/studentconduct/.

Campus Policy in Compliance with the American Disabilities Act
If you need course adaptations or accommodations because of a disability, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Presidential Directive 97-03 requires that students with disabilities requesting accommodations must register with the Accessible Education Center at http://www.sjsu.edu/aec/ to establish a record of their disability. The AEC is located in ADM 110 (408-924-6000 [voice] or 408-924-5990 [TDD]).

Adding, Dropping, Late Withdrawals, and Incompletes

February 3 is the last day to drop this course without a "W" being assigned. According to University policy, dropping this course after Feb. 3 is permissible only for serious and compelling reasons, and requires written documentation. Unsatisfactory performance in course work is not a serious and compelling reason. The last day to add the course is Feb. 10. However, students who receive add codes should use them within 24 hours, or the space may be given to another student. The university policies on late withdrawals and incompletes will be strictly followed.

Recording in Class

Common courtesy and professional behavior dictate that you notify individuals when you are recording them. You must obtain the instructor's permission to make audio or video recordings in this class. Such permission allows the recordings to be used for your private, study purposes only. The recordings are the intellectual property of the instructor; you have not been given any rights to reproduce or distribute the material. Recording any students during class activities requires permission of those individuals as well as permission from the instructor.

Course Materials

Course material developed by the instructor is the intellectual property of the instructor and cannot be shared publicly without his/her approval. You may not publicly share or upload instructor generated material for this course, such as exam or quiz questions, lecture notes, or hand-outs without instructor consent.

Biomechanical Instrumentation

50 points are available
   a)   Labs (20% - 10 points)
   b)   Quizzes (20% - 10 points)
   c)   Lab Practical Exam (20% - 10 points)
   d)   Biomechanics Concepts Exam (20% - 10 points)
   e)   Biomechanical Modeling Exam (20% - 10 points)
   f)   Make-up labs and quizzes are <u>NOT</u> permitted
   g)   Make-up exams are permitted <u>ONLY</u> for serious and compelling reasons.

Course Content Knowledge Examinations (PLO 1-3; SLO 7,9)

1) Biomechanical Concepts Exam
   a. Multiple Choice questions related to course content knowledge
2) Biomechanical Modeling Exam
   a. Written assessment of your ability to use course content knowledge in real-world settings to enhance movement performance, prevent injuries, and assess rehabilitation progress.
3) Lab Practical Exam
   a. Quantitative and qualitative assessment of your ability to use course content knowledge, data collection methods, and data analysis methods in real-world settings to enhance movement performance, prevent injuries, and assess rehabilitation progress.
      i.   Collect and analyze acceleration data
      ii. Collect and analyze video/kinematic data
      iii. Interpret acceleration data
      iv. Interpret video/kinematic data
4) All course content exams are cumulative
5) No scantrons or green books are required
6) Make-up exams are permitted <u>ONLY</u> for serious and compelling reasons.

Quizzes (PLO 1)

1) Given at beginning of every lecture.
2) **CLOSED** book, notes, and neighbor.
3) Make-up quizzes **<u>WILL NOT</u>** be given under any circumstances.

Laboratory Work (SLO 7-11)

1) Students are expected to attend and participate regularly in laboratories
2) Lab assignments must be turned in by the due date assigned for each
3) Late lab assignments will not be accepted and will receive zero points

Exercise Physiology Instrumentation

Evaluation	Weighting	Student Learning Outcomes
Competency Tests (2% each)	10%	1,2
Professionalism, Care of Equipment	5%	1
Anthropometric Lab	5%	1,3
BIA Lab	5%	1,3
Skinfold Lab	5%	1,3
Hydrostatic Weighing Lab	5%	1,3
Bod Pod Lab	5%	1,3
Spirometry Lab	5%	1,3
Trifit & Cholestech Lab	5%	1,3
Body Composition Project	10%	1,3,5,6
Quizzes (6 of 7 counted)	17%	3,4,6
Lab Practical - Spirometry	5%	1,2,6
Written Final Exam	18%	1,3,4,5,6

Competency Tests

Students will demonstrate competency on the following:
- Measuring height
- Measuring weight
- Measuring circumferences
- Measuring diameters
- Measuring skinfolds

Grading on competency tests:

A (95%) = excellent technique (performed smoothly & with confidence, accurate results)
B (85%) = good technique (minor corrections needed)
F (50%) = poor or weak technique (significant errors, questionable data)
0 pts   = did not attempt competency

Students receiving less than an A grade will receive feedback and may, after further practice, retake the competency on another day. If a student does not attempt a competency by the first deadline date, the score may be lowered one letter grade for each week, or part of a week, that the deadline is missed. The last day to complete competencies is Wed., March 11.

Labs and Body Composition Project

Guidelines and forms are in the course reader. Refer to the class schedule for due dates. Written work must be typed or neatly hand-written. Remember to proofread and check for completeness before turning in.

Due Date	Received	Grade Lowered
Monday	After class Mon. through Wed.	1 grade step (eg, B+ ➜ B)
	Thurs. or Fri.	2 grade steps (eg, B+ ➜ B-)
	Sat. through following Mon.	1 full grade (eg, B+ ➜ C+)
Wednesday	After class Wed. through Fri.	1 grade step
	Sat. through Mon.	2 grade steps
	Tues. or following Wed.	1 full grade

Students must speak with the instructor regarding assignments that are over 1 week late.

Laboratory Practical - Spirometry

- Students will demonstrate skill in obtaining pulmonary measurements using the Collins spirometer.
- A 15 minute test session will be scheduled; all measurements must be completed in this time period.
- After a student is tested, he/she will serve as the client for the next individual. If there is no test immediately before, the student being tested must bring a client. The client may NOT be a class member unless he/she has been tested.
- Grades will be based on ability to: (a) give accurate and complete instructions to participant, (b) administer test correctly and obtain accurate data. **Calculations are not required during the laboratory practical.**
- During the practical exam, students who realize they have made an error should correct the error. (It's better to correct an error than to hope/think it will be undetected. Proficiency in testing includes recognizing your errors.)
- Grading: 90-100% = No errors or very minor errors, technique & data are good
    - 80-89%   = Some errors, needs additional practice
    - 60-79%   = Significant errors, needs correction and practice
    - <60%   = Very poor technique or unable to obtain measurements without help; data are invalid

Converting Letter Grades to Percentages

A+ = 98%	A = 95%	A- = 91%
B+ = 88%	B = 85%	B- = 81%
C+ = 78%	C = 75%	C- = 71%
D+ = 68%	D = 65%	D- = 61%
F = ≤ 50%		

Quizzes & Written Midterm Exam

- In-class quizzes (Quizzes 1-5) and the midterm exam will cover theoretical background, use of equipment, data collection and interpretation.

- Questions may include true-false, multiple choice, short answer, problems, and calculations.

- Pre-lab questions (completed online – Canvas) **MUST** be completed before 8:00 am on the due date. There is **no** make-up or second chance to complete the pre-lab questions, so **plan accordingly!** If you start early enough, you will have options if there are technological problems (e.g., on-campus computers if your computer breaks or you have internet connection problems). If you wait until the last minute and there are technological problems, accept the consequences without complaint. The total points on the pre-lab questions will be equivalent to two quiz scores. Quiz 6 = pre-lab questions on skinfolds, hydrostatic weighing, and ADP. Quiz 7 = pre-lab questions on environmental conditions/pulmonary and health/fitness assessments. Pre-lab questions are to be completed independently, NOT in a group. Carefully read the information on the University's Academic Integrity Policy; violations will be reported with appropriate sanctions taken. Earning your college degree is important – think carefully before jeopardizing this process!

- Six of seven quiz scores will be counted; the lowest quiz score will be dropped.

Make-ups for in-class quizzes and exams are permitted only for illness and emergency (TRULY EXTRAORDINARY CIRCUMSTANCES). The student is responsible for notifying the instructor and making arrangements at the earliest possible time. In most cases, the quiz/exam must be completed before the next class meeting. All requests for make-up exams will be evaluated on an individual basis. Again, there is **NO MAKE-UP** for missed pre-lab questions.

Example

Component	% Earned	X	Points Possible	Points
Competency Tests	B, A, A, A, A, 85%, 95%, 95%, 95% 95% Avg = 93.3%	X	10	9.3
Professionalism	90%	X	5	4.5
Anthropometric Lab	83%	X	5	4.15
BIA Lab	94%	X	5	4.7
Skinfold Lab	80%	X	5	4.0
Hydrostatic Lab	85%	X	5	4.25
Bod Pod Lab	95%	X	5	4.75
Pulmonary Lab	72%	X	5	3.6
Trifit Lab	100%	X	5	5.0
Body Comp. Project	91%	X	10	9.1
Quizzes	Avg = 82%	X	17	13.94
Lab Practical - Spirometry	80%	X	5	4.0
Written Final Exam	85%	X	18	15.3
Total for exercise physiology half of course 86.59 out of 100 pts converted to 43.295 out of 50 pts for exercise physiology half of course 50 pts possible in exercise physiology half; 50 pts possible in biomechanics half of course				86.59

PROPOSED SCHEDULE

(Subject to change with fair notice –any changes will be announced in class)

Exercise Physiology

*Readings from Heyward & Wagner text. In addition to the text assignments, students should read the appropriate sections of the exercise physiology course reader BEFORE class.

CT: Date for completion of first attempt at competency test

DATE	TOPIC	*TEXT ASSIGNMENT	DUE
Mon., Jan. 26	Lec: Course Intro., Body Composition Assessment Lab: Anthropometric Measurements (Height, Weight, Circumferences, Diameters)	Chaps. 1, 5	
Wed., Jan. 28	Lab: Height, Weight, Circumferences, Diameters		
Mon., Feb. 2	Lec: BIA Lab: Height, Weight, Circs, Diameters, BIA	Chaps. 6, 10	
Wed., Feb. 4	Lab: Circs, Diameters, BIA		CT: Height & Weight
Mon., Feb. 9	Lec: Skinfold Measurements **QUIZ 1** (Body Comp Assessment, Height, Weight, Circumferences, Diameters, BIA) Lab: Skinfolds, Ht, Wt, Circ, Diam, BIA	Chaps. 2, 4	Pre-lab on Skinfolds
Wed., Feb. 11	Lab: Skinfolds		Anthropometric & BIA Labs CT: Circ & Diam
Mon., Feb. 16	Lec: Hydrostatic Weighing **QUIZ 2** (Skinfolds) Lab: Skinfolds, Hydrostatic Weighing	pp. 27-33, 37-40 Chap. 15	Pre-lab on Hydrostatic Weighing
Wed., Feb. 18	Lab: Hydrostatic Weighing		Skinfold Lab

DATE	TOPIC	*TEXT ASSIGNMENT	DUE
Mon., Feb. 23	Lec: Air Displacement Plethysmography (ADP or Bod Pod) & DXA **QUIZ 3** (Hydrostatic Weighing) Lab: Bod Pod & DXA Demonstration, Hydrostatic Weighing	pp. 33-37, 40-47, Chap. 11	Pre-lab on ADP & DXA
Wed., Feb. 25	Lab: Bod Pod & DXA		Hydrostatic Weighing Lab CT: Skinfolds
Mon., Mar. 2	Lec: Environmental Conditions & Pulmonary Function **QUIZ 4** (ADP & DXA) Lab: Spirometry, Bod Pod		Pre-lab on Environ. Conditions & Pulmonary
Wed., Mar. 4	Lab: Spirometry		Bod Pod Lab Body Comp Project
Mon., Mar. 9	Lec: Health & Fitness Assessments **QUIZ 5** (Envir. Conditions & Pulmonary Function) Lab: Trifit & Cholestech, Spirometry		Pre-lab on Health & Fitness Assmts.
Wed., Mar. 11	Lab: Trifit System & Cholestech		Spirometry Lab
Mon., Mar. 16	Lec: Body Comp Data, Catch Up & Review Lab: **Lab Practicals**		
Wed., Mar. 18	**Midterm Exam (written)**		Trifit Lab

Biomechanics

3-30, 4-1	**Baseline Data Collection and Analysis**
	• Review of Biomechanics Conceptual Knowledge
	• Data Collection and Analysis Concepts
	    ○ 3D Acceleration
	• Data Collection and Analysis Activities
	    ○ 3D Acceleration
		Chapter 1
		Chapter 1 Handout
		Lecture Handout 1
		Lab 1

4-6 & 4-8	**Biomechanical Model for Minimizing Sum of Joint Forces when Landing after a Vertical/Horizontal Jump**
	• Review of Biomechanics Conceptual Knowledge
	• Data Collection and Analysis Concepts
	    ○ 2D Video
	• Data Collection and Analysis Activities
	    ○ 2D Video
	    ○ 3D Acceleration
		Chapter 3
		Chapter 3 Handout
		Lecture Handout 2
		Lab 2

4-13 & 4-15	**Biomechanical Model for Maximizing Jump Height/Distance**
	• Review of Biomechanics Conceptual Knowledge
	• Data Collection and Analysis Activities
	    a) 2D Video
	    b) 3D Acceleration
		Chapter 2
		Chapter 2 Handout
		Lab 3

4-20 & 4-22	**Biomechanical Model for Minimizing Joint Loads During Horizontal Locomotion (Walking and Running)**
	• Review of Biomechanics Conceptual Knowledge
	• Data Collection and Analysis Activities
	    a) 2D Video
	    b) 3D Acceleration
		Chapter 4
		Chapter 4 Handout
		Locomotion Handout
		Lab 4

4-27 & 4-29	**Biomechanical Model for Minimizing Movement Time during Horizontal Locomotion (Walking and Running)**
	• Review of Biomechanics Conceptual Knowledge
	• Data Collection and Analysis Activities
	    a) 2D Video
	    b) 3D Acceleration
		Chapter 4
		Chapter 4 Handout
		Locomotion Handout
		Lab 5

5-4 & 5-6	**Pre/Post Data Comparison**
	• Data Collection and Analysis Activities
	    a) 2D Video
	    b) 3D Acceleration
		Lab 6

5-11 & 5-13	**Lab Practical Exam**	
Fri. 5-15 7:15-9:30 am	**Final Exam: Biomechanical Concepts and Biomechanical Modeling**	