

KINE 501: Motor Control

California State University San Marcos

Fall 2019

CRN: 43050

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Office Hours:	By appointment		4 Credit Hours

“From there to here, from here to there, funny things are everywhere.” – Dr. Seuss

COURSE DESCRIPTION

Investigates the interactions among neural, physiological, and musculoskeletal systems that underlie movement. We will evaluate current hypotheses for movement control at the neuromotor and behavioral levels. Emphasis will be placed on neuromotor impairment, and therapeutic and technological approaches to improving motor function. The laboratory component involves designing and performing experiments to test hypotheses about motor control, learning, and rehabilitation.

CONTENT LEARNING OUTCOMES

Our overall learning objective is to understand how humans (and other organisms) generate and maintain effective movements. Completing this course involves being able to:

1. Demonstrate understanding of the principles of neuromotor control of human movement.
2. Discuss and apply concepts related to prehension, locomotion, control theory, information processing, and motor mechanisms.
3. Have knowledge of neurological impairments, including physiological mechanisms and implications for motor control.
4. Be able to apply theories of practice and feedback and their effects on motor performance.

SKILL LEARNING OUTCOMES

Another objective of this course is to become more skilled in scientific reasoning and quantitative measurement, analysis, and evaluation. Completing the course involves being able to:

1. Apply general principles and knowledge of motor control to specific movement contexts.
2. Effectively read, understand, analyze, and evaluate scientific literature.
3. Generate hypotheses that are novel, important, reasonable and testable.
4. Use data acquisition tools (of Force and Motion) to quantitatively measure human movement.
5. Use functional programming (MATLAB) to analyze data.
6. Use data and basic statistics to evaluate motor control hypotheses.
7. Identify sources of uncertainty and use them to weigh evidence.
8. Construct arguments to defend hypotheses, experimental methods, and data-based conclusions.
9. Report scientific findings using clear, well-organized written and oral presentation.

KINESIOLOGY PROGRAM GOALS

This course is designed to contribute to all Kinesiology Program Goals:

1. Describe fundamental principles of Kinesiology, including anatomy and physiology, teaching movement related skills, physiological response to exercise, and the mechanics and control of movement.
2. Apply Kinesiology related skills to real-world problems through empirical research, internships, field experience, and/or service learning.
3. Evaluate movement science questions through 1) the performance of health, fitness, and movement assessment, 2) the acquisition, analysis, and interpretation of original data, and 3) the appraisal and application of information from current research literature.
4. Utilize oral and written communication that meets appropriate professional and scientific standards in Kinesiology.
5. Model behavior consistent with that of a Kinesiology professional, including 1) advocacy for a healthy, active lifestyle, 2) adherence to professional ethics, 3) service to others, 4) shared responsibility and successful collaboration with peers, and 5) pursuit of learning beyond CSUSM.

GRADUATE COURSE

KINE 501 is a graduate course. What does that mean? Graduate courses in the Department of Kinesiology typically involve more in-depth investigation of topics and require greater use of critical thinking and analytical skills than is normally expected at the undergraduate level. Graduate courses typically:

1. Involve understanding concepts, issues, problems, and/or techniques that are current topics of scholarly investigation.
2. Require understanding of both theoretical principles and applied content.

3. Require analysis of primary research and/or professional literature.
4. Require students to identify sources of uncertainty in measurement and interpretation.
5. Require students to consider alternative hypotheses and complex, multi-factorial systems.
6. Provide opportunities to apply research findings to solving relevant problems.
7. Encourage independent and creative thinking and problem-solving.
8. Require students to weigh uncertainty, evaluate competing hypotheses, and make determinations of the most likely/reasonable explanations, predictions or strategies for action.
9. Require written and oral communication at a professional level.

COURSE CONTENT

The main content for this course will be derived through reading primary literature. *There is no required text for this course.* The following is a partial list of references for course topics.

1. Latash, M.L. (2008). *Neurophysiological Basis of Movement*, 2nd ed. Human Kinetics: Champaign, IL.
2. Schmidt, R.A., Lee, T.D. (2011) *Motor Control and Learning*, 5th ed. Human Kinetics: Champaign, IL.
4. Kandel, E.R., Schwartz, J.H., Jessell, T.M. (2000). *Principles of Neural Science* 4th ed. McGraw-Hill Medical: New York, NY.

WEBSITE

Notes, handouts, online lectures, quizzes, instructor correspondence, grades, etc. will be available through the course website. If you need help with web access or computer use or have any unique needs, please contact the instructor.

EMAIL

I always make an effort to respond to emails as promptly and thoroughly as possible. To facilitate prompt responses, it is important for me to be able to easily identify class emails. Consequently, I request that any emails that you send me about the course begin with "KINE501" in the subject line. For example, a subject could read "KINE501: Appointment Request." I cannot guarantee responses to emails that do not have "KINE501:" in the subject. In the case that I am slow to respond to an email, please feel free to simply re-send the message. My inbox gets out of control sometimes, and emails can get lost or mis-filed, and I appreciate the reminder if I have somehow misplaced a message or failed to respond for any other reason.

SCHEDULES

The schedules and reading assignments contained in this syllabus may be subject to change. It is up to you to make sure that you are aware of all announcements concerning changes in the course outline, readings, assignments, exams, and other matters made during class periods whether or not you are in attendance when announcements are made. Some assignments for each class are listed below. Reading the material before class is likely to lead to more interesting class time and also facilitate studying.

ATTENDANCE

Regular attendance is essential. Many missed assignments, including quizzes or lab activities, CANNOT be made up, except in the case of university business or approved holiday. Accepting late assignments is not fair to other students for several reasons. For example, it interferes with our ability to discuss assignments during class periods.

CLASSROOM COURTESY

Please follow these guidelines for common courtesy:

- Respect individual diversity of each person in the class.
- Turn Cell Phones off before class, do not text message.
- Do not listen to a device during class time, including keeping the ear piece in your ear.
- Use computers in class only for class activity. Attempts to multitask (i.e. texting, etc.) will decrease performance

ACCOMODATIONS FOR DISABILITIES

We will make any reasonable accommodations for limitations due to any disability including learning disabilities. Please arrange an appointment to see me to discuss any needs you might have. All discussions are confidential. Students with disabilities who require academic accommodations must be approved for services by providing appropriate and recent documentation to the Office of Disabled Student Services (DSS). This office is located in Craven Hall 4300 and can be contacted by phone at (760) 750-4905, TDD (760) 750-4909 or by email at: dss@csusm.edu. Students authorized by DSS to receive accommodations should meet with me during my office hours, or in another private setting, in order to ensure your confidentiality. **Note:** Please inform me during the

first week of classes about any disability or special needs that you have that may require specific arrangements related to attending the class sessions, carrying out class assignments, or writing papers or examinations.

COLLABORATIVE WORK

You will work in small groups to complete lab assignments, discuss assignments, and complete some quiz questions (e.g. KSLO 5). However, online quiz answers must be submitted individually. Collaborative work is an opportunity to learn from each other, divide labor on assignments, learn through teaching, meet others in the class and major, become accustomed to team-based work, etc. Therefore, collaborative work is an important part of the class and your grade will reflect your contribution to the success of your groups. Evidence of leadership, effort, organization, congeniality and flexibility will favorably reflect on your performance in the class. However, collaborative work is not meant to include sending emails to the entire class with answers to quizzes or tests, which is considered a violation of the honesty and integrity policies.

WRITING

The University has an "All-University Writing Requirement" that students write at least 2,500 words for a 3 or more unit course. The University requirement reflects the importance of writing for virtually every field of study and career. Therefore, we will emphasize writing (specifically scientific/technical writing), and assessments for most laboratory work will be written papers.

FORMATTING IS NOT WRITING. You may have been told (repeatedly) to use APA or MLA reference formatting. In my opinion, the emphasis on APA reference formatting comes at great cost to actually learning how to write. I don't care in the slightest how your references are formatted, so long as they are clear and complete (including complete references that I can cross-check). Margins, spacing, reference styles, etc. are matters of appearance and are NOT important for this class.

What IS important is that you write using specific, concise, and clearly-written sentences. MOST important is that you structure your paragraphs and papers using REASONING (deductive and/or inductive): that you lead the reader to specific, clear conclusions using specific, clear evidence. Use APA formatting if you want – I don't care. So long as your papers are well-reasoned, I'm good.

For additional guidance on writing, refer to the online resource [Reasoned Writing / A Framework for Scientific Papers](https://reasonedwriting.moodlecloud.com/) (<https://reasonedwriting.moodlecloud.com/>). A more mobile-friendly version of the [Reasoned Writing](http://www.reasonedwriting.com/) site is available at <http://www.reasonedwriting.com/>.

OFFICE HOURS

I encourage you to make use of office hours, or make appointments to come talk to me if you have questions or concerns. I have observed dramatic improvements in grades through one-on-one interaction. I also appreciate any and all feedback about the structure of the course, the material, ideas for making things better, etc. Feedback provided will not affect grading decisions.

My office is in UH 310. If you arrive for an appointment and my door is closed, please knock. I keep the door open for all meetings with students, without exception.

CLASSROOM HONESTY AND INTEGRITY

Honesty and integrity are a reflection of your character. Therefore, cheating is considered a serious offense. Students will be expected to adhere to standards of academic honesty and integrity, as outlined in the Student Academic Honesty Policy. All written work and oral presentation assignments must be original work. All ideas/material that are derived from other sources must have appropriate references to the original sources. Any quoted material should give credit to the source and be punctuated with quotation marks.

Students are responsible for honest completion of their work including examinations. There will be no tolerance for infractions. If you believe there has been an infraction by someone in the class, please bring it to the instructor's attention. The instructor reserves the right to discipline any student for academic dishonesty, in accordance with the general rules and regulations of the university.

Disciplinary action may include the lowering of grades and/or the assignment of a failing grade for an exam, assignment, or the class as a whole. Incidents of Academic Dishonesty will be reported to the Dean of Students. Sanctions at the University level may include suspension or expulsion from the University.

Students are expected to conduct themselves in a manner appropriate for class and comply with the rules of student conduct. The rules of student conduct are included in the California Code of Regulations, Title 5, and beginning at Section 41301. A student who violates university policies or regulations is subject to disciplinary action, which can result in a warning, reprimand, probation, suspension, or expulsion. The Chancellor of the California State University specifies procedures under which the university may take disciplinary action against a student. Procedures are on file in the Office of the Dean of Students, Craven Hall, Room 5306.

LABORATORY GUIDELINES

Laboratories will consist of designing hypothesis-based studies to test questions in biomechanics. Frequently, lab activities will involve (1) a short review of the problems and relevant literature highlighting a gap in our knowledge of a particular problem; (2) generating both GENERAL and MEASURABLE hypotheses (3) designing an experiment that will allow for controlled, quantitative measurements; (4) collecting data using laboratory equipment and techniques; (5) analyzing the collected data to test the measurable hypothesis; and (6) discussion of the implications of the outcomes of the experiment on the general hypothesis, potential limitations that could have affected the results, and potential alternative interpretations. Specific guidelines for effective scientific writing and presentation will be an important component of the laboratory.

Requirements for Lab

- Attendance and participation are mandatory, except for health reasons at the discretion of the professor. The instructor will take Roll at the beginning of lab.
- No food allowed in the laboratory.
- Proper attire, including closed-toed shoes is required.
- Laboratory write-ups are due on the dates specified.
- Leaving without completion of the in-class portion of your lab will be considered an absence.

Recommendations for Lab

- Computers will be available for data analysis. There will be up to 20 students in the lab section. You may choose to bring your own laptop computer for data analysis.
- On some lab days, we will only have one data collection system and 20 students. You will have down time. A productive student might choose to use this down time to work on their homework assignments and/or discuss them with other students.

Lab Assignments

Laboratory assignments will be made available for download from Cougar Courses. Assignments will contain three parts: **preparation, lab activities, and assignments**. You will be expected to arrive prepared by completing pre-laboratory assignments (online lectures, readings, etc.). During the lab activity section, you must complete the lab activity before you leave for the day. You may choose to work on the analysis section of your laboratory assignment at home or in the computer lab if you prefer. However, it is recommended that you make use of your instructor's assistance in completing the lab requirements. Your lab assignment will be due as indicated (typically the next time that your lab section meets). *Laboratory papers that are not typed will not be accepted.* Many lab sections involve acquiring or reinforcing specific **skills**. Although you will work in groups, it is important to make sure that you are competent with each required skill, because each skill will be required for future labs.

PAPER SUBMISSION

Laboratory handouts will be collected at the end of each laboratory period. Written papers will be submitted through **Turnitin**. Please include your name within any document that you submit.

PLAGIARISM

“Plagiarism” can be defined as using another's words, ideas, materials or work without properly acknowledging and documenting the source. Students are responsible for knowing the rules governing the use of another's work or materials and for acknowledging and documenting the source appropriately.

GRADING.

Grades will be assigned according to points earned during the course. The course is NOT curved (it is criterion-referenced, not norm-referenced). If everyone gets an "A," then I'll be ecstatic.

GRADING	Points	Percent of final grade
Class Attendance	60	12%
Assignments	100	20%
Quizzes	100	20%
Literature Grids (2)	20	4%
Proposal Outlines (2)	20	4%
Project Write-Ups (2)	150	30%
Project Presentations (2)	50	10%
Total	500	100%

POINTS	PERCENTAGE	LETTER GRADE
500-465	100%-93.0%	A
464-450	92.9%-90.0%	A-
449-440	89.9%-88.0%	B+
439-415	87.9%-83.0%	B
414-400	82.9%-80.0%	B-
399-390	79.9%-78.0%	C+
389-365	77.9%-73.0%	C
364-350	72.9%-70.0%	C-
349-340	69.9%-68.0%	D+
339-300	67.9%-60.0%	D
299-000	59.9%-0.00%	E

CLASS SCHEDULE

Subject to change at any time

Classes are Tuesday 3:00-5:50 PM (University Hall 240), 1:00-3:50 Thursday (Academic Hall 209)

Date	Topic	Questions	Assignment
27 AUGUST LAB 1	Introduction to the course Learning objectives Principles of functional programming	What is the difference between scripting and programming? Why is abstraction such a fundamental part of programming?	- Required reading: Latash (2008)
29 AUG DISCUSSION	Principles of Motor Control: Mechanical Task Constraints	What are the "problems" that must be solved by motor control?	- Required reading: Dickinson et al. (2000) Hogan and Flash (1987)
03 SEPTEMBER LAB 2	Science Frameworks and Hypotheses Programming in MATLAB	How do we make and apply discoveries in complex fields such as motor control? What are scientific models and hypotheses? How can the programming principle of 'abstraction' help create and organize hypotheses? How do we use a 4GL language like MATLAB?	- Required reading: Goodstein: "How Science Works" Reasoned Writing (Section 3: Logic; Topics 24-36) A Framework for Scientific Papers (Topics 1-4: Hypotheses)
05 SEPT	Principles of Motor Control: Segmented and Jointed Systems	How can we make movements using segments connected by joints? How do we control movements such as locomotion or prehension?	- Required reading: Dounskaia (2005) Torricelli et al. (2016)
10 SEPTEMBER LAB 3	Testing Hypotheses Programming in MATLAB	How do we test hypotheses anyway? How do we deal with Vectors and Arrays? How do we use functions to harness the power of abstraction and modular programming?	- Required reading: A Framework for Scientific Papers (Topics 5-8: Testing Hypotheses) Platt (1964) Programming assignment 1
12 SEPT	Principles of Motor Control: Muscle Function	How do muscles actuate movements? How do muscle properties constrain motor control?	- Required reading: Zajac (1989) Zajac (1993)
17 SEPTEMBER LAB 4	Testing Hypotheses Programming in MATLAB	Is there only one way to test hypotheses? Can we both reject and support hypotheses? How? How do we use Conditionals and Loops? How do we manage files, input, and output to MATLAB?	- Required reading: A Framework for Scientific Papers (Topics 9-11: Testing Hypotheses) Fedak et al., (2015) Programming assignment 2
19 SEPT	Principles of Motor Control: Motor Recruitment and Synergies	How do neurons activate muscles?	- Required reading: Hodson-Tole and Wakeling (2009) Giszter (2010)
24 SEPTEMBER LAB 5	Frameworks Programming in MATLAB	How can explicitly creating strong frameworks help us design experiments and write papers? How do we visualize data in MATLAB?	- Required reading: Reasoned Writing (Section 1: Frameworks, Topics 1-16) Programming assignment 3

26 SEPT	Principles of Motor Control: Peripheral Sensory Feedback	How does peripheral sensory feedback contribute to motor control?	- Required reading: Windhorst (2007) Kurtzer (2015) Arm Function Literature Grids
01 OCTOBER LAB 6	Reasoning PROJECT 1: Arm Function General Hypotheses/Model selection	How can thinking about reasoning and logic simplify the process of scientific communication? How do humans coordinate arm movements?	- Required reading: Reasoned Writing (Section 2: Reasoning, Topics 8-23) Arm Function Project Proposal Outline: Overall Topic Area and General Hypothesis
03 OCT	Principles of Motor Control: Coordination	How are muscles, joints, and limbs coordinated to achieve precise movements?	- Required reading: Turvey (1990) Diedrichsen (2009)
08 OCTOBER LAB 7	Simplicity PROJECT 1: Arm Function Experiment Design	How can striving for simplicity help in experimental design and scientific communication?	- Required reading: Reasoned Writing (Section 4: Simplicity, Topics 37-51) Arm Function Project Proposal Outline: Measurable Hypotheses and Experimental Design
10 OCT	Principles of Motor Control: Internal Models	Do we have internal models of our bodies and the environment to help plan and control movement?	- Required reading: Shadmehr et al., (2010) Miall and Wolpert (1996)
15 OCTOBER LAB 8	Specificity PROJECT 1: Arm Function Data Collection	How can striving for specificity help in experimental design and scientific communication?	- Required reading: Reasoned Writing (Section 5: Specificity, Topics 52-59) Data
17 OCT	Principles of Motor Control: Variability and the Environment	How do animals and humans compensate for variability in motor output and in the environment? Is variability important for motor learning?	- Required reading: Biewener and Daley (2007) Dhawale et al., 2017
22 OCTOBER LAB 9	Scientific Papers PROJECT 1: Arm Function Data Collection	How do we use frameworks, reasoning, simplicity, and specificity to construct strong, persuasive Introduction and Methods sections?	- Required reading: A Framework for Scientific Papers (Section 2, Introduction and Methods)
24 OCT	PROJECT 2: Legged Movement General Hypotheses/Model selection		Legged Movement Literature Grids
29 OCTOBER LAB 10	PROJECT 1: Arm Function Data Analysis	How do we use frameworks, reasoning, simplicity, and specificity to construct strong, persuasive Results and Discussion sections?	- Required reading: A Framework for Scientific Papers (Section 3, Results and Discussion)
31 OCT	PROJECT 2: Legged Movement		Legged Movement Project

	General Hypotheses/Model selection		Proposal Outline: Overall Topic Area and General Hypothesis
05 NOVEMBER LAB 11	PROJECT 1: Arm Function Paper Writing	How do humans coordinate movement during standing, transitions, walking, or running?	Arm Function Papers
07 NOV	PROJECT 2: Legged Movement General Hypotheses/Model selection		Legged Movement Proposal Outline: Measurable Hypotheses and Experimental Design
		ARM FUNCTION PAPERS DUE	
12 NOVEMBER LAB 12	PROJECT 2: Legged Movement Experiment Design	How do we use frameworks, reasoning, simplicity, and specificity to improve our spoken presentations?	- Required reading: A Framework for Scientific Papers (Section 4, Narrative and Spoken Communication)
14 NOV		LEGGED MOVEMENT PROJECT PROPOSALS DUE	
19 NOVEMBER LAB 13	PROJECT 2: Legged Movement Data Collection		
21 NOV	PROJECT 2: Legged Movement Data Collection		
26 NOVEMBER 28 NOVEMBER	THANKSGIVING RECESS (NO LAB OR LECTURE)		
03 DECEMBER LAB 14	PROJECT 2: Legged Movement Data Analysis		
05 DEC	PROJECT 2: Legged Movement Writing		
12 DECEMBER 1:45PM - 3:45PM		FINAL PRESENTATIONS – LEGGED MOVEMENT	
15 DECEMBER		LEGGED MOVEMENT PAPERS DUE	

“Stay Hungry. Stay Foolish” – Stewart Brand