KNES 385: Motor Control and Learning

Semester: Fall 2011
Classroom & Time: SPH 1312 – Mon and Wed 11-11:50 am
Instructor: Dr. John Jeka
Office: SPH 2357
Phone: 301-405-2512
Email: jjeka@umd.edu
Faculty Website: www.sph.umd.edu/KNES/faculty/jjeka/

Office Hours: Mon 10-11 am

Teaching Assistant: Jason Green
Office: SPH 0226
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TA Website: http://sph.umd.edu/KNES/people/gfellows.html

Office Hours: Wed 10-11 am

Teaching Assistant: David Logan
Office: SPH 0226
Phone: 301-405-2574
Email: dlogan@umd.edu
TA Website: http://sph.umd.edu/KNES/people/gfellows.html

Office Hours: Th 3-4 pm

Credit Hours: Three
Prerequisites: None

Course Website: Log onto your Blackboard account at http://www.elms.umd.edu and go to your discussion section from the Home Page.

Course Description: An introductory course investigating how humans are able to control, coordinate, and learn a variety of motor skills, ranging from activities of daily living to the performance of elite athletes.


Lecture notes: Available on the Blackboard course website.
Course Learning Objectives
At the conclusion of this course, students should be able to:
1. Define and compare/contrast: motor learning, control, performance, coordination, skill, and ability.
2. Classify motor skills based on established criteria.
3. Identify characteristics of skillful behavior.
4. Compute, utilize, and interpret outcome and process measures used to assess motor control, coordination and learning.
5. Identify and describe characteristics of the learning process.
6. Describe and compare/contrast methods used to assess motor learning.
7. Explain the effects of different practice ‘variables’ on motor learning, including practice variability, schedule, distribution, amount, skill decomposition, etc.
8. Explain the effects of demonstration/modeling on motor learning and identify factors/variables that increase the effectiveness of demonstration.
9. Explain the effects of augmented information on motor learning and identify variables/factors that increase the effectiveness of augmented information.
10. Name and describe the components/structures of the nervous, muscular, and skeletal systems that are critical for motor control.
11. Describe the function of these components critical for motor control and explain why each is important for the execution of a variety of motor skills (i.e., gross vs. fine skills, open vs. closed, etc.).
12. Name and describe disorders/impairments of the nervous, muscular, and/or skeletal systems that impact motor skill execution.
13. Explain how the components of the nervous, muscular, and skeletal systems introduce several ‘problems’ for motor control.
14. Compare and contrast the physiological plausibility, advantages, and disadvantages of the hypotheses/theories developed in order to address the problems in motor control.
15. Demonstrate understanding of human information processing, and the techniques used to investigate these processes.
16. Discuss the strengths and weaknesses of the information processing approach in terms of facilitating our understanding of motor control and learning
17. Describe and explain the role(s) of memory and attention in motor learning and control.
18. Analyze and critically evaluate scientific publications in the field of motor control and learning.
19. Empirically examine research questions in the field of motor control and learning via the scientific method.

Kinesiology Competencies Addressed in this Course:
The following competencies for the Kinesiology program are addressed in this course:
1. Know, apply, and evaluate scientific principles of physical activity as a foundation for healthy living.
2. Describe and critically analyze the role of physical activity in health, wellness, and the quality of life.
Course Outline

UNIT I
1.1 Introduction to Motor Control and Learning
   a) A ‘how-to’ for KNES 385
   b) Motor performance vs. motor control vs. motor learning
   c) Motor skills and abilities
   d) Classification of motor skills
   e) Characteristics of skillful performance
1.2 Assessment of Motor Skill Performance
   a) Outcome measures
      i) Types of error scores
         (1) Variable, constant, absolute
      ii) ‘Timing’ measures
         (1) Reaction time, response time, movement time, etc.
   b) Process measures
      i) Kinematics, kinetics, brain imaging, electromyography (EMG)
1.3 Motor Learning
   a) Characteristics of the learning process
   b) Assessment of motor learning
      i) Retention
      ii) Transfer
   c) Stages of motor learning
1.4 Effects of Practice
   a) Variability of practice
   b) Practice schedule
   c) Contextual interference
   d) Distribution of practice
   e) Amount of practice
   f) Deliberate practice
1.5 Assisting the Learning Process
   a) Observational learning
   b) Augmented feedback
      i) Knowledge of results
      ii) Knowledge of process

UNIT II
2.1 Peripheral contributions to motor control
   a) Motor control, revisited
   b) Review of the nervous system
      i) Functional unit of the NS
      ii) Synapses
      iii) Organization and plasticity
   c) Peripheral nervous system
      i) Sensory receptors
      ii) Somatosensory system
      iii) Vestibular system
      iv) Visual system
      v) Motor unit
2.2 Central contributions to motor control
   i) Relaying information: Tracts/pathways
   ii) Spinal control of movement
   a) The brain – making sense of sensory information
b) The brain – planning movements  
c) The brain – motor control

**UNIT III**  
3.1. Motor Control: Theories  
a) Problems in motor control  
i) Degrees of freedom  
ii) (Memory) storage capacity  
iii) Context-conditioned variability  
iv) Perceptual-motor integration  
v) Skill acquisition  
vi) Execution of novel movements  
vii) ‘Units’ of motor control  
viii) Execution of fast movements  
b) Theories/Approaches/Heuristics to Address Problems in Motor control  
i) Open and closed loop control  
ii) Motor programs and schema theory  
iii) Synergies  
iv) Internal representations  
v) Dynamical systems  
vi) Ecological theory of perception-action  

3.2. Information processing  
a) Cognitive approach to psychology  
b) Information processing model  

**UNIT IV**  
4.1. Influence of memory  
a) Brief neuroscience of memory  
b) Measuring memory  
c) Short-term memory  
d) Long-term memory  

4.2. Attention and the search for information  
a) Attention as limited resource and performance limitation  
b) Capacity and resource theories of attention  
c) Pre-attention  
d) Visual search for information  

**Course Requirements/Student Evaluation**  

*Examinations*  
70% of Final Grade  
There will be a total of four (4) examinations over the course of the semester including the final exam. The dates of the examinations are included in the Course Schedule below. Students are responsible for the material covered in the lectures, discussion sections, and the assigned readings. The first three examinations are each worth fifteen percent (15%) of the final grade and will cover only the material since the last exam. The final examination is *cumulative* is worth twenty-five percent (25%) of the final grade.

*Discussion*  
10% of Final Grade  
Students are required to attend and participate in the weekly discussion sections. The discussion sections are intended to provide students with active learning experiences and are based on two types of activities/assignments: 1) reading, evaluating, and discussing scholarly articles in the area of motor control and learning; and, 2) developing experimental paradigms and completing the subsequent data
collection and analysis necessary to answer research questions in the area of motor control and learning. Students will be provided an additional syllabus in the appropriate discussion section that will provide further details. It should be emphasized that an unexcused absence from a discussion section will prevent the student from turning in the related assignments (see Make-up policy below).

Final Project 10% of Final Grade
Students will work in groups of 4-5 in order to complete a final project. The focus of this project will be the development of a novel experiment to investigate a specific research question. Students will develop the research question, design an appropriate experiment, collect and analyze data, compose a formal research report, and present their findings. Additional details will be presented in the discussion sections.

Quizzes/In-Class Assignments 10% of Final Grade
There will be weekly quizzes over the course of the semester. These are intended to assess the students’ level of understanding of the material presented in lectures, discussion sections, and the assigned readings. They will be given via Blackboard and need to be completed by Tuesday night at midnight to receive credit. Please note that each question will have a time limit and once the quiz / assignment is started, the student must complete it in its entirety.

Extra Credit
Students will be provided opportunities for extra credit. Specifics of these opportunities will be given during the semester. Students are allowed a maximum of two (2) extra credit opportunities, each worth an additional 2% to the final exam. Accordingly, students can earn a maximum amount of 4% to their final exam grade.

Grading
Final grades will be based on a weighted average of the examinations (70%), discussion section (10%), final project (10%), and quizzes (10%). There is no rounding of grades. Absolutely no exceptions!!

<table>
<thead>
<tr>
<th>Grade</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>A+</td>
<td>96.67 – 100%</td>
</tr>
<tr>
<td>A</td>
<td>93.33 – 96.66%</td>
</tr>
<tr>
<td>A-</td>
<td>90.00 – 93.32%</td>
</tr>
<tr>
<td>B+</td>
<td>86.66 – 89.99%</td>
</tr>
<tr>
<td>B</td>
<td>83.33 – 86.65%</td>
</tr>
<tr>
<td>B-</td>
<td>80.00 – 83.32%</td>
</tr>
<tr>
<td>C+</td>
<td>76.66 – 79.99%</td>
</tr>
<tr>
<td>C</td>
<td>73.33 – 76.65%</td>
</tr>
<tr>
<td>C-</td>
<td>70.00 – 73.32%</td>
</tr>
<tr>
<td>D+</td>
<td>66.66 – 69.99%</td>
</tr>
<tr>
<td>D</td>
<td>63.33 – 66.65%</td>
</tr>
<tr>
<td>D-</td>
<td>60.00 – 63.32%</td>
</tr>
<tr>
<td>F</td>
<td>&lt; 60.00%</td>
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</table>

Course Policies
Class Participation
The University policy on attendance is available on http://www.testudo.umd.edu/soc/atedasse.html and in the Undergraduate Catalog. This policy includes information about overall class participation including: religious holidays, inclement weather, excused absences, makeup exam.

Absence Policy
In accordance with university policy, if you are absent for a single lecture due to illness or some form of personal or family emergency, this absence will be considered “excused” and the instructor will accept a note from you, attesting to the date of the illness/incident, along with an acknowledgement that the information is true. Whenever feasible, you should try to contact the instructor in advance.

Multiple or prolonged absences, and absences that prevent attendance at a major scheduled grading event like an exam or semester project presentation, will require written documentation from an appropriate health care provider/organization.

For complete information on the university’s absence policy see: http://www.president.umd.edu/policies/v100g.html

Email – The Official University Correspondence
Verify your email address by going to www.my.umd.edu.

All enrolled students are provided access to the University’s email system and an email account. All official University email communication will be sent to this email address (or an alternate address if provided by the student). Email has been adopted as the primary means for sending official communications to students, so email must be checked on a regular basis. Academic advisors, faculty, and campus administrative offices use email to communicate important and time-sensitive notices.

Students are responsible for keeping their email address up to date or for redirecting or forwarding email to another address. Failure to check email, errors in forwarding email, and returned email (from “full mailbox” or “unknown user” errors for example), will not excuse a student from missing University announcement, messages, deadlines, etc. Email addresses can be quickly and easily updated at www.my.umd.edu or in-person at the Student Service Counter on the first floor of the Mitchell Building.

For technical support for University email: www.helpdesk.umd.edu or call 301-405-1400.

Late work and Missed Exams / Assignments Make-up Policy
Without documentation of a University-excused absence, there will be no make-ups for ANY of the course requirements/assignments. This includes the examinations, discussion section activities, final project, and quizzes/in-class assignments. If a student does have a University-excused absence, the professor AND the appropriate teaching assistant must be notified twenty-four (24) hours prior to the date in question and alternate arrangements will be made.

Attendance/In-class assignments
Students are expected to attend each lecture and the appropriate discussion section. In addition to missing important material which will be the focus of the examinations, failure to attend will prevent the student from completing the in-class assignments or quizzes (see Make-up Policy above). Moreover, the student is expected to be on-time for the lecture and to remain for the entire class period. In-class assignments may be given in the beginning, middle, or end of a lecture. If you miss an assignment due to tardiness or early departure, there will be no make-ups.

Submitting Assignments via Blackboard
Students will be required to submit assignments via Blackboard. This includes weekly discussion assignments, components of the semester project, etc. Your TA will demonstrate how to do this during the first discussion section. However, there are two important guidelines for on-line submitting:

1) To avoid any potential problems or errors in formatting, we strongly recommend students to submit documents in PDF format. Many of the computers on campus have Adobe software
to convert into a PDF. If students cannot convert to a PDF, assignments **MUST** be submitted in the 2003 Microsoft Word (i.e., .doc) format. The 2007 Microsoft Word version (.docx) will absolutely **NOT** be accepted.

2) Students must submit assignments with the following naming convention:
   `LastName_FirstName_Section#_AssignmentTitle`
   **Example:** Jeka_John_0101_Assign1LitReview

   If these guidelines are not followed, the assignment will not be graded and will automatically receive a grade of zero (0).

**Examinations**
As stated above, there will be four (4) examinations, including the Final Exam. The dates of these exams are listed in the Course Outline/Schedule. Without documentation of a University-excused absence, there will be no make-ups for an examination (see Make-up Policy above). Moreover, fifteen (15) minutes after the start of an examination, the doors to the room will be locked. If a student arrives after this 15-minute grace period, he/she will **NOT** be allowed to take the examination and there will be no make-ups.

**Assigned Readings**
Students are expected to complete the assigned readings that are posted on the course website (see Course Schedule for a list of these readings). These readings will supplement the lectures as well as the discussion sections and the material covered in these readings will be included in the lecture examinations, in-class assignment/quizzes, and discussion section activities.

**Religious Observances**
The University System of Maryland policy provides that students should not be penalized because of observances of their religious beliefs; students shall be given an opportunity, whenever feasible, to make up within a reasonable time any academic assignment that is missed due to individual participation in religious observances. **It is the student’s responsibility to inform the instructor at the beginning of the semester or at least one week in advance of any intended absences for religious observance.**

The policy that includes information about Religious Observance is available on:
http://www.president.umd.edu/policies/iii510a.html

**Special Accommodations / Disability Support Services**
If you have a documented disability and wish to discuss academic accommodations for test taking or other needs, you will need documentation from Disability Support Service (301-314-7682). If you are ill or encountering personal difficulties, please let the instructor know as soon as possible. You can also contact Learning Assistance Services (301-314-7693) and/or the Counseling Center (301-314-7651) for assistance. The University services for students with disabilities is available on:
http://www.counseling.umd.edu/DSS/avail_services.html

**Academic Integrity**
The University’s code of academic integrity is designed to ensure that the principle of academic honesty is upheld. Any of the following acts, when committed by a student, constitutes academic dishonesty:
- **CHEATING**: intentionally using or attempting to use unauthorized materials, information, or study aids in an academic exercise.
• **FABRICATION**: intentional and unauthorized falsification or invention of any information or citation in an academic exercise.
• **FACILITATING ACADEMIC DISHONESTY**: intentionally or knowingly helping or attempting to help another to violate any provision of this code.
• **PLAGIARISM**: intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise.

For more information see: [http://www.shc.umd.edu/code.html](http://www.shc.umd.edu/code.html).

The Honor Pledge is a statement undergraduate and graduate students should be asked to write by hand and sign on examinations, papers, or other academic assignments. The Pledge reads:

*I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination.*

The University of Maryland, College Park has a nationally recognized Code of Academic Integrity, administered by the Student Honor Council. This Code sets standards for academic integrity at Maryland for all undergraduate and graduate students. As a student you are responsible for upholding these standards for this course. It is very important for you to be aware of the consequences of cheating, fabrication, facilitation, and plagiarism. For more information on the Code of Academic Integrity or the Student Honor Council, please visit [http://www.shc.umd.edu](http://www.shc.umd.edu).

**Inclement Weather / University Closings**
In the event that the University is closed for an emergency or extended period of time, the instructor will communicate to students regarding schedule adjustments, including rescheduling of examinations and assignments due to inclement weather and campus emergencies. Official closures and delays are announced on the campus website ([http://www.umd.edu](http://www.umd.edu)) and snow phone line (301-405-SNOW), as well as local radio and TV stations.

**Early Warning Grades**
Early warning grades will be submitted for those undergraduate students who are newly enrolled at Maryland. These grades are an important component of our retention efforts as they provide timely feedback to those students who are unfamiliar with our academic expectations. A letter grade or “satisfactory/unsatisfactory” (S/U) marks may be submitted.

**Course evaluation**
Your participation in the evaluation of courses through CourseEvalUM is a responsibility you hold as a student member of our academic community. Your feedback is confidential and important to the improvement of teaching and learning at the University as well as to the tenure and promotion process. CourseEvalUM will be available online ([www.courseevalum.umd.edu](http://www.courseevalum.umd.edu)) for you to complete your courses evaluations. By completing all of your evaluations each semester, you will have the privilege of accessing the summary reports for thousands of courses online at Testudo.

**Available Support Services**
The University has a legal obligation to provide appropriate accommodations for students with special needs (permanent or temporary, physical or mental). If a student has a documented special need and wishes to discuss academic accommodations, please contact the instructor within one (1) week of the first day of class.
# Course Schedule

<table>
<thead>
<tr>
<th>Date (Mon)</th>
<th>Topic</th>
<th>Reading</th>
<th>Date (Wed)</th>
<th>Topic</th>
<th>Reading</th>
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<tbody>
<tr>
<td>8/31</td>
<td>Intro</td>
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<td>9/7</td>
<td>Motor Skills/Abilities</td>
<td>Magill: 1,3</td>
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<tr>
<td>9/5</td>
<td>No Class</td>
<td>NA</td>
<td>9/7</td>
<td>Motor Skills/Abilities</td>
<td>Magill: 1,3</td>
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<tr>
<td>9/12</td>
<td>Assessing Performance</td>
<td>Magill: 2</td>
<td>9/14</td>
<td>Performance</td>
<td>Magill: 2</td>
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<td>9/19</td>
<td>Motor Learning</td>
<td>Magill: 11-13</td>
<td>9/21</td>
<td>Practice</td>
<td>Magill: 16-18</td>
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<tr>
<td>9/26</td>
<td>Feedback</td>
<td>Magill: 14-15</td>
<td>9/28</td>
<td>Catch up/Review</td>
<td>NA</td>
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<tr>
<td>10/3</td>
<td><strong>Exam #1</strong></td>
<td>NA</td>
<td>10/5</td>
<td>Peripheral Nervous System</td>
<td>Magill: 4,6</td>
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<td>PNS</td>
<td>Magill: 4,6</td>
<td>10/12</td>
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<td>Magill: 4-6</td>
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<td>10/24</td>
<td>Review</td>
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<td>10/26</td>
<td><strong>Exam #2</strong></td>
<td>NA</td>
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<td>Theories - Motor Control</td>
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<td>Information Processing</td>
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<td>11/16</td>
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<td>Magill: 7-8</td>
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<td>11/23</td>
<td>No Class</td>
<td>NA</td>
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<tr>
<td>11/28</td>
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<tr>
<td>12/5</td>
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<td>Magill: 9</td>
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<tr>
<td>12/12</td>
<td>Catch-up/Review</td>
<td>NA</td>
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</tbody>
</table>

**Final Exam (Exam #4): Saturday, Dec 17 8-10 am**

Note: The schedule above is tentative and the instructor reserves the right to make modifications.

*BB = Blackboard course website

**Dates of Interest:**
1) Schedule Adjustment ends September 14, 2011
2) Last day to drop the course is November 9, 2011 (grade of W – withdrawal).