Course Description:
The application of mechanical principles to the analysis of human movement in daily living, work settings, sport and exercise. Quantitative video analysis techniques are introduced and applied to selected movement analysis projects. 3 credits. Prerequisites: Kin 480, Phys 101/111

Course Overview:
The goal of this course is to provide students with an understanding of the theoretical underpinnings of the science of biomechanics and a working knowledge of techniques used in the quantitative analysis of human movement. Course activities will include:
1. Traditional lecture / discussions with support through PowerPoint materials.
2. Homework, computer based laboratory activities and discussions of problems in basic kinematics, projectile motion, spreadsheet-based analysis of movement kinematics data, and torque calculations.
3. Video based analysis of selected movements, including class discussions of data interpretation and findings.

Course Content:
The course objectives are to enhance student learning in the following content areas:
A. Introduction - the role of biomechanics in the study of human movement.
B. Linear Kinematics.
   1. Scalar and vector quantities, vector components, vector magnitudes.
   2. Velocity and acceleration vectors.
   3. Uniformly accelerated motion, projectiles.
C. Linear Kinetics.
   3. Frictional force.
   4. The impulse momentum relationship.
   5. Conservation of momentum.
D. Angular Kinematics.
   1. Angular position and angular displacement.
   2. Angular velocity, angular acceleration.
   3. Circular motion.
E. Angular Kinetics.
   2. Torque, resultant moment, lever systems, center of gravity.
   3. Joint torque and Joint reaction forces.
F. Fluid Mechanics and Swimming Hydrodynamics
Learning Objectives and Student Learning Outcomes:
At the end of this course the student will be able to demonstrate mastery of the following learning objectives:

1. Understand how to analyze data for a movement analysis research project.
2. Understand how measures of position, velocity and acceleration can be used to quantify human movement.
3. Understand the mathematical relationship between position, velocity and acceleration.
4. Understand and apply the equations of uniformly accelerated motion.
5. Understand Newton’s laws and apply these laws in the calculation and analysis of the forces that cause motion.
6. Understand how the body’s center of gravity location is computed from video data.
7. Understand how to calculate torque for basic lever systems.
8. Understand how fluid forces influence human motion in water.

Course Materials:
Kin 485 Course Reader – Schleihauf. Spring 2015 (available at Copy Edge Printing; 1508 Ocean Ave.)

Hand Calculator: required for exams (a cell phone may NOT be used during exams
Flash drive: students are responsible for backing up all work done on lab PCs.

Method of Evaluation:
Course grades are computed “on a curve” where letter grades are determined by class rank. If your score is equal to the average score for the full class, you should expect a grade of C. The score categories are shown below:

Homework assignments / quizzes: 20 points
Laboratory Participation: 200 points
Midterm: 100 points
Final: 250 points

Note: Homework assignments and lab assignments must be completed on time – no late submissions will be accepted. Students are always expected to work independently, especially on homework assignments.

A video analysis term presentation is an important option in the course. The details on this project are described in the Term Presentation Requirements section of this reader.

Scoring Details:
Lab: Attendance in all laboratory sessions is mandatory. Lab participation will be quantified through measures of the number of minutes spent on each 50 minute computer based laboratory exercise. Students who spend the full 50 minute time in each lab and work steadily will get the maximal score (if you take a break during the lab time, stay overtime to make up for the break). Students who spend less than 30 minutes will earn zero points. Students who spend less than 49 minutes but more than 30 minutes will earn half credit for the lab. There is one rare exception: if the full content of the lab is completed and the lab questions are correctly answered for at least 75% of the questions, the laboratory work files are complete and reading scores do not indicate skimming, full credit will be given for students who spend between 30 and 49 minutes for the lab. Attendance at lab is required. Missed labs cannot be made up during open lab or other times. Limited extra credit opportunities will be available for those who feel the need to augment their scores.
Homework assignments must be completed on time and handed in during class meetings – no late submissions will be accepted. To receive full credit for a homework, an attempt to answer every question must be shown (incorrect answers for the homework receive full credit). Do not copy answers from others; use the homework to prepare for quizzes and exams.

The midterm and final exams questions will be drawn from assigned readings, laboratory exercises, class notes and homework assignments. The class PowerPoint class notes will emphasize selected portions of the textbook but will not cover all of the materials in the book or on the exams. To do well on exams, complete all reading assignments and remember details from the book, the lab exercises and the class discussions. In addition, be prepared to solve problems like those assigned for homework as well as those problems described and solved in the class textbook.

Details on the optional term presentation scoring are in a separate section of this reader. Your term point score total will be graded on a curve. Letter grades from various sub sections (midterm, term presentation) will not be averaged; the sum total of the numerical scores will be used in the calculation of the final term grade.

**Equations and Exams:**

**Note:** Homework assignments and lab assignments must be completed on time – no late submissions will be accepted. Students are always expected to work independently, especially on homework assignments.

It is not necessary to memorize all of the equations that are used to solve problems on exams. The following equations will be provided on the midterm and final exam answer sheets:

- \( \text{Cos (angle)} = \frac{\text{adjacent}}{\text{hypotenuse}} \)
- \( \text{Sin (angle)} = \frac{\text{opposite}}{\text{hypotenuse}} \)
- \( \text{Vmag} = \sqrt{Vx^2 + Vy^2} \)
- \( \text{Vave} = \frac{(P_f - P_i)}{t} \)
- \( \text{Aave} = \frac{(V_f - V_i)}{t} \)
- \( V_f = V_i - 9.8 \times t \)
- \( D = V_i \times t - 4.9 \times t^2 \)
- \( D = V \times t \)
- \( V_f^2 = V_i^2 - 19.6 \times D \)
- \( F = m \times a \)
- 1 pound = 4.45 Newtons
- mass in kilograms = pounds / 2.2
- 1 radian = 57.3°
- \( V_f = \omega \times R \)
- Torque = force \* lever arm
- \( T = I \times \alpha \)
- \( L = \frac{1}{2} \rho \times V^2 \times CL \times S \)
- \( D = \frac{1}{2} \rho \times V^2 \times CD \times S \)

Other equations, such as those that express the definition of a biomechanical concept, will not be provided on exams.
College Policy Course Requirements

Classroom Behavior: The classroom is a special environment in which students and faculty come together to promote learning and growth. It is essential to this learning environment that respect for the rights of others seeking to learn, respect for the professionalism of the instructor, and the general goals of academic freedom are maintained. Differences of viewpoint or concerns should be expressed in terms which are supportive of the learning process, creating an environment in which share of themselves without losing their identities, and to develop and understanding of the community in which they live. Student conduct which disrupts the learning process shall not be tolerated and may lead to disciplinary action and/or removal from class.

As a courtesy to others, please refrain from the use of cell phones and/or eating in class.

Cheating and Plagiarism: Cheating is the actual or attempted practice of fraudulent or deceptive acts for the purpose of improving one’s grade or obtaining course credit; such acts also include assisting another student to do so. Typically, such acts occur in relation to examinations. However, it is the intent of this definition that the term ‘cheating’ not be limited to examination situation only, but that it include any and all actions by a student that are intended to gain an unearned academic advantage by fraudulent or deceptive means. Plagiarism is a specific form of cheating which consists of the misuse of the published and/or unpublished works of others by misrepresenting the material (i.e., their intellectual property) so used as one’s own work. Penalties for cheating and plagiarism range from 0 or F on a particular assignment, through an F for the course, to expulsion from the university.

Americans with Disabilities Act (ADA) Accommodation: The University is committed to providing reasonable academic accommodation to students with disabilities. The Disability Programs and Resources Center provides university academic support services and specialized assistance to students with disabilities. Individuals with physical, perceptual, or learning disabilities as addressed by the Americans with Disabilities Act should contact Services for Students with Disabilities for information regarding accommodations. Please notify your instructor so that reasonable efforts can be made to accommodate you. If you expect accommodation through the Act, you must make a formal request through Disability Programs & Resource Center in SSB110, Telephone 338-2472.

Additional CHSS Required Policies

CHSS Withdrawal Policy: The last day to drop a class is February 6th, 2015 until 11:59pm. Starting February 7th – April 24th, 2015 you must submit a withdrawal petition. Withdrawal from a class starting February 7th, 2015 will be considered for serious and compelling reasons only and must have accompanying documentation. The following reasons are not considered serious and compelling: Changing your major, poor performance, class not required for graduation/major, or more time needed for other classes. If you wish to withdraw from class due to unexpected changes in your work schedule, illness or family emergencies, documentation will be required, along with a copy of unofficial transcripts. If you are requesting a withdrawal, bring your petition and appropriate documentation to the instructor. From April 25th, 2015 to May 15th you may not withdraw from a class or the University, except in the case of a serious documented illness or verified accident. Please refer to the following website for further information on withdrawal policies: https://chss.sfsu.edu/advising/

CR/NC Option: The last day to request CR/NC option is March 20th, 2015 until 11:59pm. The Associate Dean will not approve requests for changes if you miss this deadline.

Late Add Policy: The period to add classes via permit numbers is January 26th- February 6th, 2015. The period to add classes by Exception (2nd set of permit numbers) is February 7th-20th, 2015. It is your responsibility to procure a late permit number from your instructor and add the class. Faculty cannot add you into a class. Starting February 21st, 2015 a Waiver of College Regulations form must be signed by your instructor, Chair and CHSS Associate Dean to add. This will be approved only if there was an administrative error.
Check your registration through SF State Gateway: Sign up for CR/NC, drop and add classes by the appropriate deadline online through SF State Gateway. ALWAYS check your registration after making any changes and BEFORE deadlines to be sure you are registered properly for your classes. This is a student responsibility. Deadlines for all registration procedures, including withdrawals and requests for credit/no credit, are listed in the class schedule and will be strictly adhered to by the instructor, the Department Chair and the Associate Dean of College of Health & Social Sciences.

This can be viewed on the Registration Calendar at the following website:
http://www.sfsu.edu/~admisrec/reg/regsched.html

Disability Programs and Resource Center: Students with disabilities who need reasonable accommodations are encouraged to contact the instructor. The Disability Programs and Resource Center (DPRC) is available to facilitate the reasonable accommodations process. The DPRC, located in SSB 110, can be reached by telephone at 415-338-2472 (voice/TTY) or by e-mail at dprc@sfsu.edu.
# Kin 485 – Biomechanics – Tentative Schedule of Classes – Spring 2015

This syllabus and schedule are subject to change in the event of extenuating circumstances. If you are absent from class, it is your responsibility to check on announcements made while you were absent.

Attendance in all labs is required. Laboratory exercises cannot be made up at a later date.

<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
<th>Class Topic</th>
<th>Reading</th>
<th>HW</th>
<th>Lab</th>
<th>Sec#</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mon</td>
<td>1/26</td>
<td>Introduction, Research example</td>
<td>Ch 1, RES 74, 83</td>
<td></td>
<td>Review</td>
<td></td>
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<tr>
<td>Wed</td>
<td>1/28</td>
<td>Term Paper discussion; KA Software Intro</td>
<td>Ch 2, 3; Excel Ch.</td>
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<td>PC Software</td>
<td>2</td>
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<tr>
<td>Mon</td>
<td>2/2</td>
<td>Linear Kinematics</td>
<td>Ch 4, 5</td>
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<td>PC Software</td>
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<tr>
<td>Wed</td>
<td>2/4</td>
<td>Kinematics - Vectors, Velocity</td>
<td>Ch 6, 7</td>
<td></td>
<td>Vectors</td>
<td>2</td>
</tr>
<tr>
<td>Mon</td>
<td>2/9</td>
<td>Kinematics - Acceleration</td>
<td>Ch 8</td>
<td>HW 1</td>
<td>Vectors</td>
<td>1</td>
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<tr>
<td>Wed</td>
<td>2/11</td>
<td>Kinematics - projectile motion</td>
<td></td>
<td>HW 2</td>
<td>Projectiles</td>
<td>2</td>
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<tr>
<td>Mon</td>
<td>2/16</td>
<td>Kinematic - projectile motion, scale factor</td>
<td>Ch 9, KAMan 1, 2</td>
<td>HW 3</td>
<td>Projectiles</td>
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<tr>
<td>Wed</td>
<td>2/18</td>
<td>Kinematic Analysis velocity chart</td>
<td>KAMan 3, 4</td>
<td>HW 4</td>
<td>KA/Excel</td>
<td>2</td>
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<tr>
<td>Mon</td>
<td>2/23</td>
<td>Issues in Video Digitizing</td>
<td>KAMan 5, 6, 7</td>
<td>HW 5</td>
<td>KA/Excel</td>
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<tr>
<td>Wed</td>
<td>2/25</td>
<td>Kinetics - Newton's laws</td>
<td>Ch 10, 11</td>
<td>HW 6</td>
<td>GRF</td>
<td>2</td>
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<tr>
<td>Mon</td>
<td>3/2</td>
<td>Kinetics - External forces</td>
<td></td>
<td></td>
<td>GRF</td>
<td>1</td>
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<tr>
<td>Wed</td>
<td>3/4</td>
<td>Kinetics - External forces, Friction</td>
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<td>HW 7</td>
<td>Applied Force</td>
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<tr>
<td>Mon</td>
<td>3/9</td>
<td>Kinetics - Momentum, Impact</td>
<td>Ch 12</td>
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<td>Applied Force</td>
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<tr>
<td>Wed</td>
<td>3/11</td>
<td>Kinetics - Impact, Impulse</td>
<td>Ch 13</td>
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<td>Impulse</td>
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<tr>
<td>Mon</td>
<td>3/16</td>
<td>Kinetics - Work, Energy</td>
<td>Ch 13</td>
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<td>Impulse</td>
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<tr>
<td>Wed</td>
<td>3/18</td>
<td><strong>Exam #1</strong></td>
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<tr>
<td>Mon</td>
<td>3/23</td>
<td>Spring Break</td>
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<tr>
<td>Wed</td>
<td>3/25</td>
<td>Spring Break</td>
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<tr>
<td>Mon</td>
<td>3/30</td>
<td>Angular Kinematics</td>
<td>Ch 14</td>
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<td>Data Review</td>
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<td>Wed</td>
<td>4/1</td>
<td>Angular Kinematics</td>
<td>Ch 15, 16, 17, 18</td>
<td>HW 8</td>
<td>Eccentric Forces</td>
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<tr>
<td>Mon</td>
<td>4/6</td>
<td>Joint Angles, Summation of force</td>
<td>Ch 19, 20</td>
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<td>AngKinemat</td>
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<td>Wed</td>
<td>4/8</td>
<td>Angular Kinetics - Intro, Moment of Inertia</td>
<td>Ch 21, 22</td>
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<td>SumForce</td>
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<td>Mon</td>
<td>4/13</td>
<td>Torque Calculations: Moment, CG.</td>
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<td>SumForce</td>
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<td>Wed</td>
<td>4/15</td>
<td>Angular Momentum</td>
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<td>Eccentric Forces</td>
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<tr>
<td>Mon</td>
<td>4/20</td>
<td>JICalc software</td>
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<td>Eccentric Forces</td>
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<td>Wed</td>
<td>4/22</td>
<td>JICalc software</td>
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<td>Review</td>
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<tr>
<td>Mon</td>
<td>4/27</td>
<td>JICalc software / Data Review day</td>
<td>Ch 23</td>
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<td>JICalc</td>
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<tr>
<td>Wed</td>
<td>4/29</td>
<td>Fluid Mechanics</td>
<td>Ch 24, 25</td>
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<td>JICalc</td>
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<td>Mon</td>
<td>5/4</td>
<td>Swimming Biomechanics</td>
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<tr>
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<td>5/6</td>
<td>Swimming Biomechanics</td>
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<tr>
<td>Mon</td>
<td>5/11</td>
<td>Presentations</td>
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<tr>
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<td>5/13</td>
<td>Review</td>
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<tr>
<td>Fri</td>
<td>5/22</td>
<td><strong>Final Exam 8:00 - 10:30</strong></td>
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