9-2014

PT 529.01: Biomechanics

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PT 529 – Biomechanics
Fall 2014
UM - School of Physical Therapy and Rehabilitation Science

I. Course Coordinator and Primary Instructor:

Ryan L. Mizner, PT, PhD
SB 135, 243-5183, ryan.mizner@umontana.edu
OFFICE HOURS: Thurs 12:10-1pm or by appointment as needed

Co-Instructors
Audrey Elias, PT, DPT, OCS
SB 015, 243-2609, audrey.elias@umontana.edu

Sambit Mohapatra, PT, PhD
SB 110, 243-2429, sambit.mohapatra@umontana.edu

II. Credits: 4

III. Contact Hours: 84 hrs of contact time with lecture and lab

IV. Class and/or Lab Times from August 25 – Oct 14, 2014:

Mon:	8:10-10am Skaggs 025
Tues:	8:10-10am Skaggs 025
Wed:	8:10-10am Skaggs 025
Wed:	1:10-3pm Skaggs 114
Thursday:	8:10-10am Skaggs 025/020
Thursday:	10:10-12pm Skaggs 020

V. Prerequisites and Co-requisites

Prerequisites:Coursework prior to DPT school; Co-requisites: PT 510 Applied Clinical Anatomy

VI. Course description:

This course is focused on how the principles of biomechanics are applied to the practice of physical therapy. Mechanical properties of biological tissue, kinematics, kinetics, muscle actions, and joint structure and function are examined. Emphasis is on biomechanical concepts and their relationship to the fundamental understanding of therapeutic interventions, musculoskeletal examination, and musculoskeletal evaluation.

VII. Required Textbooks/Readings and Materials:

*Neumann, D.A., (2nd ed., 2010). *Kinesiology of the Musculoskeletal System*. St. Louis: Mosby. ISBN-10: 0323039898.

*Mueller, MJ & Maluf, KS (2002). Tissue adaptation to physical stress: A proposed "physical stress theory" to guide physical therapist practice, education, and research. *Phys Ther*, 82(4), pp 383-403.
***Available at library or at http://www.ncbi.nlm.nih.gov/pubmed/11922854

*Materials: Iclicker and calculator. You **may not** use your phone as your calculator for PT 529

Supplemental Readings:

A. Handouts, videos, professional references, textbooks, website links
B. Moodle registration is mandatory (http://umonline.umt.edu/). Please be sure to update your personal info regularly as well as checking your email daily for the latest updates. I will often use Moodle to send email communication to the class.

VIII. Course Objectives:

At the conclusion of the class, the student will or will be able to:

1. Develop an understanding of human motion and biomechanical concepts in order to begin to examine, evaluate, diagnose, and treat movement dysfunction.
2. Begin to evaluate and implement available evidence to aid in the understanding of human movement, evaluative procedures, and clinical decision making.
3. Develop a clinically practical knowledge and understanding of common anatomical and biomechanical terminology and classifications.
    a. Conduct an observational movement analysis for a normal movement that includes: the joint or segment movements, the source of forces, muscles and type of contraction, effects on center of mass, and anticipated effects of internal and external forces such as ground reaction forces
4. Describe the planes and axes of motion for movements of the joints in the human body.
5. Apply principles of biomechanics in the process of evaluating and understanding normal and abnormal movements as they relate to physical therapy interventions and injury prevention.
6. Apply basic principles of skeletal muscle physiology and biomechanics in the process evaluating and identifying normal and abnormal movements.
7. Develop and interpret free body diagrams of the forces and moments acting on a given object.
8. Describe the mechanical properties of tissues of the musculoskeletal system and the relationship of these properties to function, injury, treatments, injury prevention, and wellness programs.
9. Understand the properties of viscoelastic tissues and describe and anticipate appropriate connective tissue responses to various types of loading.
10. Describe factors that contribute and influence the mobility and stability of joints.
11. Develop an understanding of normal and abnormal movement of joints in relation to arthrokinematics and osteokinematics of the joints of the human body.
12. Understand the biomechanical processes involved in normal and abnormal ventilation as they related to principles of physical therapy practice.
13. Describe the joints of the spine in relation to their plane and axes of motion and form a working understanding of their contributions to various normal and abnormal trunk movements.
14. Describe and analyze clinically important aspects of the skeletal muscular system as they impact normal and abnormal movement of joint.
15. Develop a 3-dimensional image/concept of gait for the purpose of patient evaluation and treatment planning.
16. Identify the phases and expected significant events within the gait cycle.
17. Evaluate joint motion at the hip, knee and ankle during a walking and running gait cycle.
18. Demonstrate entry-level knowledge of the moments of force acting at the hip, knee and ankle joints during the stance phase of gait in terms of evaluating for abnormal gait patterns.
19. Compare normal gait with abnormal gait as a result of a variety of physical impairments (muscle weakness or shortness, excessive muscle tone, etc).
20. Demonstrate knowledge of ground reaction forces acting on the human body gait by comparing typical and atypical ground reaction forces.
21. Compare the motion of the upper extremities and trunk with motion of the pelvis and lower extremities during gait.
22. Explain the role and the clinical importance of each of the determinants of gait.
23. Demonstrate knowledge of the types, purpose, and advantages/disadvantages of various means of motion analysis techniques use in evaluating gait.
24. Develop knowledge related to the biomechanical factors involved in ventilation to assist in examination, evaluation, and treatment planning of individuals with compromised ventilation systems

IX. Course Content outline:

ii. Fundamental principles and concepts of normal biomechanics.

iii. Biomechanics and applied physiology of connective tissue.

iv. Normal axial and extremity joint structure and function.
    1. Lower extremity
    2. Upper extremity
    3. Axial Skeleton and Ventilation
v. Abnormal axial and extremity joint structure and the impact on function.
vi. Normal and pathological gait analyses

X. Student Evaluation:

Exams: 1 – Biomechanics Fundamentals	16 %
2 – Lower Extremity	19 %
3 – Upper Extremity	21 %
4 – Spine	21 %
5 – Gait & Comprehensive Material	23 %
Assignments:	
Homework and Lab Assignments	P/F

Grading System:

Percentage	Grade	Grade Point
90-100	A	4.0
87-89	B+	3.3
83-86	B	3.0
80-82	B-	2.7
77-79	C+	2.3
73-76	C	2.0

Students must achieve an overall average ≥ 73% to pass the course. No repeats will be provided for written exams. Students are responsible to ensure they are prepared before taking their exams.

XI. Student Specific Responsibility

All students must practice academic honesty. Academic misconduct is subject to an academic penalty by the course instructor and/or a disciplinary sanction by the University. All students need to be familiar with the Student Conduct Code. The Code is available for review online: http://life.umt.edu/vpsa/student_conduct.php

Professional Behaviors:

Professional behaviors are expected in the course and are detailed in the student handbook. Unprofessional conduct by a student when involved in school work, in and out of the department, may also be considered grounds for unsatisfactory progress in the program and is subject to review by the Academic Requirements Committee and potentially the Dean of the College of Health Professions & Biomedical Sciences. Also, please refer to the "Generic Abilities" section in your student handbook. Use of laptops to take notes is allowed, but use of the internet to browse for unrelated topics is prohibited as it is distracting to the classroom experience and can inhibit your peers' learning.

The School's Policy on Cellular Devices, Audio & Video recording:

Cellular devices must be turned off and stowed during class. Use of a cellular device for class-related activities is permissible upon request of the instructor, but texting or web access use of the device in any communicative mode is prohibited unless otherwise permitted by an individual faculty member for his or her course. Audio or video recording of lectures or laboratory classes without written permission by the instructor or faculty member is strictly prohibited. Failure to abide by this policy is an infringement of copyrights afforded to faculty members and considered a violation of the University of Montana Student Conduct Code. Under certain circumstances (student missing class due to illness or other excused absence), faculty may choose to videotape their own classes for educational purposes. These recordings are the property of the faculty and must be returned to that faculty member. Students shall not copy or distribute the recordings.

Attendance/Remediation Policy:

Be timely to class. Regular and punctual attendance and participation at all scheduled classes and laboratories is expected and required. Absences seriously impact good academic performance making it impossible to receive instruction, obtain

knowledge, or gain the skills necessary to practice physical therapy. Missing class limits your classmates' ability to practice and learn from your input. Material presented in class is designed for you to be competent in physical therapy practice and the success of the program. If an absence is necessary, the student is to notify the instructor/School before the start of classes that day. Such absences, however, do not lessen the student's responsibility to meet the class requirements. Students will be allowed fair and equitable remediation for excused missed class material. Unexcused absence will result in a 2% reduction in the students overall percentage for the class for each miss.

Students with Identified needs:
The University of Montana assures equal access to instruction through collaboration between students with disabilities, instructors, and Disability Services for Students (DSS). If you think you may have a disability adversely affecting your academic performance, and you have not already registered with DSS, please contact them in Lommasson 154. Students are responsible for notifying the instructor of a need for accommodation. Once DSS has verified your disability, we can work together to coordinate your reasonable modifications. For more information, visit the Disability Services for Students website at http://life.umt.edu/dss.

XIV Dress code:

Lecture: I would ask for please no hats or baseball caps in the classroom.
Lab: The lab components of the course are detailed in the class schedule. You are responsible to come dressed appropriately for lab to allow access to body parts for visualization and/or palpation. Generally, this means tank top, short running type shorts, and athletic shoes. If you are not properly dressed for lab you will be asked to go change into appropriate attire to participate.
Guest Lecturers: You are expected to be dressed professionally on days class is being taught by guest lecturers unless otherwise instructed.

XV. Teaching Methods and Learning Experiences

This course combines lecture materials, small group discussions, reflection questions and self-assessment examinations, along with laboratory application activities designed to enhance the student's knowledge and understanding of biomechanical principles and their impact on clinical problems. Students will be expected to verbally participate in class, respond to questions through the use of iclicker technology, and participate fully in hands-on lab activities. Homework problems and activities will be issued for work by yourself and with partners outside of class.

XIV. Class Schedule:

Date	Type	Location	Content	Reading	Professor
8/25 - Mon 8:10-10	Lecture	025	Intro Material & *Fun*damentals	Chapt 1-4 & PST article	RLM
8/26 - Tues 8:10-10	Lecture	025	Fundamental Biomechanics	Chapt 1-4 & PST article	AE
8/27– Wed 8:10-10	Lecture	025	Fundamental Biomechanics	Chapt 1-4 & PST article	AE
8/27 -Wed 1:10-3pm	Lecture	114	Fundamental Biomechanics	Chapt 1-4 & PST article	AE
8/28 - TH 8:10-10	Lecture	025	Fundamental Biomechanics	Chapt 1-4 & PST article	RLM
8/28 - Thurs 10:10-12	Lecture	020	Fundamental Biomechanics	Chapt 1-4 & PST article	RLM
9/1 Monday			LABOR DAY TAKE OFF		
9/2 –Tues 8:10-10am	Lecture	025	Fundamental Biomech & maybe start the HIP	Chapt 1-4 &PST article	RLM
9/3 –Wed 8:10-10	**Exam 1**	**025**	**Fundamental Biomechanics Exam - RLM**		
9/3 – Wed 1:10-3	Lecture	114	Hip	Chapt 12	AE
9/4 – Thurs 8:10-10	Lecture	020	Hip & Knee	Chapt 12 & 13	AE
9/4 - Thurs 10:10-12	Lecture	020	Knee – Tibiofemoral	Chapt 12 &13	AE
9/8 - Mon 8:10-10	**Lab**	**025**	**Hip & Knee Lab**	Chapt 13	AE
9/9 – Tues 8:10-10	Lecture	025	Knee - Patellofemoral	Chapt 13	AE
9/10 - Wed 8:10-10	Lecture	025	Ankle/Foot	Chapt 14	AE
.16.199/10 - Wed 1:10-3pm	Lecture	114	Ankle/Foot	Chapt 14	AE
9/11 Thurs 8:10-12	Lecture	020	Ankle/Foot	Chapt 14	AE
9/11 – Thurs 10-12pm	**Lab**	**020**	**Ankle/Foot Lab**		AE
9/15 –Mon 8:10-10	**Exam 2**	**025**	**LOWER EXTREMITY BIOMECHANICS - AE**		
9/16 – Tues 8:10-10	Lecture	025	Shoulder biomech	Chapt 5	SM
9/17 - Wed 8:10-10	Lecture	025	Shoulder biomech cont	Chapt 5	SM
9/17 – Wed 1:10-3pm	Lecture	114	Elbow/Forearm	Chapt 5	SM
9/18 - Thurs 8:10-10	**Lab**	**020**	**Shoulder Lab**	Chapt 6	RLM/SM
9/18 -Thurs 10:10-12	Lecture	020	Wrist	Chapt 7	SM
9/22 - Mon 8:10-10	Lecture	025	Hand	Chapt 8	SM
9/23 - Tues 1:10-3pm	Lecture	114	Hand	Chapt 8	SM
9/24 - Wed 8:10-10	Lecture	020	TMJ biomech	Chapt 9-11	SM
9/24 – Wed 10:10-12	Lecture	114	Axial Skeleton	Chapt 9-11	SM
9/25- Thurs 8:10-10	Lecture	020	Axial Skeleton	Chapt 9-11	SM
9/25- Thurs 10:10-12	**Lab**	**020**	**Elbow/wrist/hand lab**		RLM/SM
9/29 – Mon 8:10-10	**Exam 3**	**025**	**Upper Extremity Biomechanics - SM**		
9/30 – Tues 8:10-10	Lecture	025	Axial Skeleton	Chapt 9-11	SM
10/1 – Wed 8:10-10	Lecture	025	Axial Skeleton	Chapt 9-11	SM
10/1 – Wed 1:10-3pm	Lecture	114	Ventilation Biomech/Review	Chapt 9-11	SM
10/2 - Thurs 8:10-10	**Lab**	**020**	**Spine/Ventilation Lab**	Chapt 9-11	RLM/SM
10/2 – Thurs 10:10-12	Lecture	020	Gait	Chapt 9-11	RLM
10/6 - Mon 8:10-10	**Exam 4**	**025**	**Axial Skeleton Biomechanics -SM**		
10/7 – Tues 8:10-10	Lecture	025	Gait	Chapt 15	RLM
10/8 – Wed 8:10-10	Lecture	114	Gait	Chapt 15	RLM
10/9 – Wed 1:10-3	Lecture	020	Gait	Chapt 15	RLM
10/10 –Thurs 8:10-10	**Lab**	**015**	**Gait Lab**	Chapt 15	RLM/AE
10/10 -Thurs 10:10-12	**Lab**	**020**	**Pathologic Gait Lab**	Chapt 15	RLM/AE
10/13 - Mon 1:10-3pm	Lecture	114	Gait & Review	Chapt 15	RLM
10/14 8:10-10am	**Exam 5**	**025**	**Gait and Comprehensive Exam - RLM**		