APPLICATION FOR NEW COURSE

1. Submitted by College of ___________________________ Date __________________________
   Department/Division offering course KHP

2. Proposed designation and Bulletin description of this course
   a. Prefix and Number KHP 616
   b. Title* Sports Biomechanics
      *NOTE: If the title is longer than 24 characters (including spaces), write a sensible title (not exceeding 24 characters) for use on transcripts

   c. Lecture/Discussion hours per week 3
   d. Laboratory hours per week
   e. Studio hours per week
   f. Credits 3

   g. Course description
      Application of fundamental concepts in biomechanics to analysis of sport skills. Class will examine how motions are created and controlled to enable specific sport performances. Mechanics related to injury will also be investigated.

   h. Prerequisites (if any)
      Undergraduate course in biomechanics
      or Consent of Instructor
   i. May be repeated to a maximum of NA (if applicable)

4. To be cross-listed as
   Prefix and Number __________________________
   Signature, Chairman, cross-listing department

5. Effective Date 8/15/06 (semester and year)

6. Course to be offered ☐ Fall ☒ Spring ☐ Summer

7. Will the course be offered each year? ☐ Yes ☒ No
   (Explain if not annually)
   Course is part of the graduate level sequence in biomechanics and will be offered every other year in the spring

8. Why is this course needed?
   Course is a required course in the graduate program in Exercise Science PhD-biomechanics option. It is also required in the masters program in KHP for exercise science students (biomechanics option) and is recommended for teaching/coaching.
   This course has been taught under a temporary KHP 782 seminar number and needs to be assigned a permanent number.

9. a. By whom will the course be taught? Robert Shapiro
   b. Are facilities for teaching the course now available? ☒ Yes ☐ No
      If not, what plans have been made for providing them?
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10. What enrollment may be reasonably anticipated? 0-15

11. Will this course serve students in the Department primarily? ☒ Yes ☐ No
   Will it be of service to a significant number of students outside the Department? ☐ Yes ☒ No
   If so, explain.

Will the course serve as a University Studies Program course? ☐ Yes ☒ No
If yes, under what Area?

12. Check the category most applicable to this course
    ☒ traditional; offered in corresponding departments elsewhere;
    ☐ relatively new, now being widely established
    ☐ not yet to be found in many (or any) other universities

13. Is this course applicable to the requirements for at least one degree or certificate at the University of Kentucky? ☒ Yes ☐ No

14. Is this course part of a proposed new program?
   If yes, which? ☐ Yes ☒ No

15. Will adding this course change the degree requirements in one or more programs?* ☒ Yes ☐ No
   If yes, explain the change(s) below

16. Attach a list of the major teaching objectives of the proposed course and outline and/or reference list to be used.

17. If the course is a 100-200 level course, please submit evidence (e.g., correspondence) that the Community College System has been consulted. ☐ Check here if 100-200.

18. If the course is 400G or 500 level, include syllabi or course statement showing differentiation for undergraduate and graduate students in assignments, grading criteria, and grading scales. ☒ Check here if 400G-500.

19. Within the Department, who should be contacted for further information about the proposed course?
   Name: Robert Shapiro
   Phone Extension: 7-9852

*NOTE: Approval of this course will constitute approval of the program change unless other program modifications are proposed.
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Signatures of Approval:

[Signature]
Department Chair

Date

Dean of the College

Date

*Undergraduate Council

Date

*University Studies

Date

*Graduate Council

Date

*Academic Council for the Medical Center

Date

*Senate Council (Chair)

Date

*If applicable, as provided by the Rules of the University Senate

Date

Date of Notice to University Senate

ACTION OTHER THAN APPROVAL

KHP 616, Sport Biomechanics, Syllabus 5
KHP 616-001

Instructor: Robert Shapiro, Ph.D., FACSM
110 Seaton Building
Office phone: 257-9852
e-mail: rahap01@uky.edu

Course Times: TBA
Course Location: TBA
Office Hours: TBA

Purpose of the Course:
Sports Biomechanics is a graduate level course in which the fundamental concepts of
musculoskeletal biomechanics are applied to sports skills. The purpose of the course is to
expand the prerequisite knowledge in basic biomechanics and apply it to investigate
fundamental sports movements such as running, throwing, swimming, and jumping.
Class discussions will examine how motions are created and controlled to enable specific
sport performance, mechanics related to selected sport techniques and parameters related
to injury associated with athletic activities.

Course Objectives:
1. To familiarize the student with the appropriate biomechanical (kinematic, kinetic, and
neuromuscular) variables utilized to understand sport performance.
2. To enable the student to become more objective in qualitative skill analysis.
3. To provide knowledge of current topics in selected aspects of the sports biomechanics.

At the conclusion of this course, the student should be able to apply the principles of
biomechanical analysis to a wide variety of sports activities.

Credit Hours: 3.0

Email: Course information will be provided via e-mail. You are required to obtain an e-
mail account for this course.

Course Text: There is no required text for this course. This course will use a combination
of selected book chapters, articles and web based materials to provide the necessary
support information for the course. (See end of syllabus for recommended texts and
suggested readings)

Written Assignment:
Materials are to be typed (word-processed) (Hand written papers will not be accepted). Late papers will lose 10% per day.

**Evaluation:**
Class participation - 10%
Article presentation - 10%
Each student will be expected to present two article reviews during the course of the semester. Specific details of the assignment will be provided in class.
Research Review - 20%
Students will be expected to prepare a detailed biomechanics literature review on a specific sport skill. Additional information will be provided in class. Due date: TBA

Exam I - 20%
Exam II - 20%
Final exam - 20%
The final exam is tentatively scheduled for: TBA

Room: TBA

**Grading:**
90-100% A
80-89% B
70-79% C
Below 70% E
* numbers will be rounded to the nearest whole number: i.e., 89.4 = 89%, 89.6=90%

**Course Topics:**
- Note: Topics may not be covered in the order listed below or several topics may be combined such as injury and specific sports. (See attachment for sample topic outline)

Mechanics review
Muscle action in sport and exercise
Locomotor sports (cycling, running, swimming, skating)
Jumping and aerial sports (high jump, long jump, ski jump, skating, diving)
Throwing sports (pitching, shot put, javelin)
Sport injury
Notes:

1) Absences: Students are responsible for work missed. Make-ups will be provided for excused absences, as listed on pages 54-55 of the University of Kentucky 2002-2003 Bulletin.

2) It is expected that all students abide by the student code with regard to submission of their work. Cheating, plagiarism or other violations of this code will result in the student receiving an "E" grade for the course and may also result in suspension or dismissal from the university. For further information review sections 6.3 and 6.4 of the Senate Rules.

Recommended Texts:


Suggested Readings (sample list):


KHP 616, Sport Biomechanics, Syllabus


Virmavirta, M., J. Perttunen, et al. (2001). "EMG activities and plantar pressures during ski jumping"


Topic Outline
Sport Biomechanics

1. Introduction

2. Review of Mechanics
   2.1. Motion
   2.2. Kinematics
   2.3. Kinetics
      2.3.1. Linear
      2.3.2. Angular
      2.3.3. Free body diagrams
      2.3.4. Center of Mass
   2.4. Projectile motion
   2.5. Equilibrium
   2.6. Link segment model
      2.6.1. Equations for 2d model
      2.6.2. Interpretation of joint forces and moments
   2.7. Work, Power and Energy
   2.8. Linear and Angular Momentum
   2.9. Impact
   2.10. Impulse
   2.11. Friction
   2.12. Fluid Dynamics
      2.12.1. Fluid properties
      2.12.2. Buoyancy
      2.12.3. Lift and Drag
      2.12.4. Bernoulli's principle
      2.12.4.1. Magnus Effect
   2.13. Mechanical characteristics of bone and ligaments
      2.13.1. Stress/strain curves
      2.13.2. Behavior of bone
      2.13.2.1. Rate and directional effects of loading
      2.13.2.2. Hysteresis
      2.13.2.3. Creep
      2.13.2.4. Stress relaxation

3. Muscle
   3.1. Basic properties
   3.2. Functional Structure
3.3. Muscle activation
   3.3.1. Recruitment
   3.3.2. EMG
3.4. Fiber Types
3.5. Intact muscle architecture
3.6. Contraction types
3.7. Muscle roles
3.8. Mechanical characteristics
   3.8.1. Hill model
3.9. Proprioception
   3.9.1. Muscle spindles
   3.9.2. Golgi tendon organs
4. Running
   4.1. History of biomechanics research on running
      4.1.1. Early Greek influence
      4.1.2. DaVinci
      4.1.3. Newton and Borelli
      4.1.4. Marey and Muybridge
      4.1.5. Braune and Fisher
      4.1.6. A.V. Hill, Eiflman and others, 1920-1940's
      4.1.7. Cavanagh-current
4.2. Kinematics
   4.2.1. Stride rate and length
   4.2.2. Pronation and supination
   4.2.3. Sagittal plane
      4.2.3.1. Hip
      4.2.3.2. Knee
      4.2.3.3. Ankle
   4.2.3.4. Upper extremity
4.2.4. Kinetics
   4.2.4.1. Ground reaction forces
      4.2.4.1.1. Vertical
         4.2.4.1.1.1. Loading rates
         4.2.4.1.1.2. Impact peak
         4.2.4.1.1.3. Propulsive peak
      4.2.4.1.2. Anterior-Posterior
      4.2.4.1.3. Medial-Lateral
      4.2.4.1.4. Center of Pressure
4.2.4.1. Foot strike patterns
4.2.4.2. Resultant joint moments
4.2.4.3. Muscle activity
4.2.4.4. Work and Power in running
4.2.4.5. Running economy
   4.2.4.5.1. Stretch-shorten cycle
4.2.5. Mechanics of running shoes

5. High Jumping
   5.1. History of the high jump
      5.1.1. Development of the "flop"
   5.2. Phases of the high jump
      5.2.1. Run-up
      5.2.2. Take-off
      5.2.3. Bar clearance
   5.3. Angular momentum
      5.3.1. Development
      5.3.2. Control
         5.3.2.1. Adjustments in flight
         5.3.2.2. "Catting"

6. Swimming
   6.1. Review of fluid forces
      6.1.1. Mechanics of new racing suits
   6.2. Mechanics of the free style
      6.2.1. Phases of the stroke
         6.2.1.1. Reaching
         6.2.1.2. Pulling
            6.2.1.2.1. Early pull-through
            6.2.1.2.2. Late pull-through
         6.2.1.3. Hand exit
   6.2.2. Muscle activity
   6.2.3. Mechanics of injuries

7. Overarm throwing
   7.1. Mechanics of the overarm pitch
      7.1.1. Phases
         7.1.1.1. Wind-up
         7.1.1.2. Early cocking
         7.1.1.3. Late cocking
         7.1.1.4. Acceleration
7.1.1.5. Release
7.1.1.6. Follow-through

7.1.2. Muscle activity
7.1.3. Aerodynamics of pitched baseballs
  7.1.3.1. How the Magnus effect causes a ball to curve
  7.1.3.2. Knuckle balls

7.1.4. Mechanics of injuries

8. Additional topics as time allows (sample topics)—each will be developed based on mechanical analysis of the skill

  8.1. Striking activities
    8.1.1. Baseball batting
    8.1.2. Golf
    8.1.3. Cricket

  8.2. Other jumping activities
    8.2.1. Long jump
    8.2.2. Ski jump

  8.3. Other throwing activities
    8.3.1. Fast pitch softball
    8.3.2. Cricket bowling
    8.3.3. Tennis serving
Professor Shapiro,

New course applications for KHP 715 and KHP 616 have been submitted and are being prepared to be submitted to the Graduate Council. During our review, I noticed the dean's signature is missing from both applications. The signature of the dean or his rep is required before the application can go forward.

Respectfully,

Cleophus V. Price

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People are always blaming their circumstances for what they are. I don't believe in circumstances. The people who get on in this world are the people who get up and look for the circumstances they want, and, if they can't find them, make them.

-- George Bernard Shaw, "Mrs. Warren's Profession" (1893) act II