#### Reflective, Innovative, Student-Centered Educators at Buffalo State College

#### SUNY Buffalo State

#### *Department of Physics*

#### *School of Arts and Science*

#### **Course Information: Physics 104: Physics for K-8 Teachers**

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Phone: (716) 868-4475 (Cell, before 8 pm)

Office hrs. via video : by appointment.

Course Particulars: This is a 3 credit-hour college physics course explicitly reserved for elementary education and early childhood majors and pre-major, with integrated laboratory, Wednesdays from 4:30-7:30pm in SAMC 359.

**Course Description**

Nature of science, energy transfer, force interactions, systems, Newton's Laws, magnetic, gravitational, light, and thermal interactions, conservation of energy, and simple circuits as appropriate for teachers of K-8 science. Meets National Science Education Standards S (NRC) and the New York State Education Department (NYSED) learning standards for Math Science and Technology and elementary and intermediate physical standards (Standard 4). Inquiry-based classroom co-mingles laboratory with lecture. Offered every semester.

**Course Schedule/Calendar**

We will complete most mechanics materials from the PET workbook and some supplementary activities appropriate for NY K-8 science curriculum. Schedule details are linked on BrightSpace.

**Course Requirements**

Required Text(s): Goldberg, et al (2015). NextGen *Physics for Everyday Thinking (PET).*

978-1-68231-343-5 Energy-based Model for (Studio style)

978-1-68231-344-2 Potential Energy and Fields (Studio style)

978-1-68231-345-9 Force-based Model for Interactions (Studio style)

978-1-68231-346-6 Combinations of Forces (Studio style)

Other Materials: You will need one or more three-ring binders to organize the books. One 2” binder should be adequate. Note physics classroom, lab and computer access will be provided to you during the days when the rooms are not in use by other classes, and you are strongly encouraged to use this. These times and days will be announced later in class.

**Title IX**

My priority as your professor is to ensure a safe, respectful education environment where all students can learn and thrive. The University does not tolerate any form of discrimination or harassment (including sexual assault, dating and domestic violence, stalking) based on protected characteristics (e.g., sex, gender identity, sexual orientation, religion, pregnancy, etc.) or related retaliation. All faculty and teaching assistants are considered mandated reporters by the University, which means that if they observe or learn of sex-based harassment/ discrimination or related retaliation, they are obligated to immediately share that information with the University’s Title IX Coordinator. This obligation, grounded in law and policy, is designed to protect the safety of students and the broader Buffalo State community, as well as ensure that students receive information about available supportive measures and resolution options to enable them to make informed choices. Supportive measures include reasonable academic accommodations available with or without the filing of a formal complaint.

If you need academic accommodations due to sex discrimination, harassment, or related retaliation, you may:

On Campus Resources: · Contact the TIX Coordinator directly (titleix@buffalostate.edu or 716-878-5212), without sharing any personal information with me. · If you would like to speak with a confidential counselor about sexual misconduct, The Counseling Center provides 24/7 confidential support for students via the Bengal Support Line (833-823-0260), or by scheduling an appointment at 716-878-4436.

· If you are a student with a disability and require reasonable accommodations to meaningfully participate in this course, please contact the University’s Student Accessibility Services at your earliest convenience (sas@buffalostate.edu or 716-878-4500), as SAS is responsible for processing and approving such requests.

· If you are pregnant, have recently experienced childbirth, and/or have medical needs related to childbirth, please contact our Title IX Coordinator for assistance. · You can file an anonymous report with our University Police Department: 716-878-6333, police@buffalostate.edu

Off Campus Resources

· Crisis Services: 24/7 hotline, 716-834-3131

· National Suicide Prevention Lifeline: 1-800-273-8255

· Family Justic Center: 716-558-7233, safe@fjcsafe.org

**Buffalo State Teacher Education Unit Goals**

These three principles--reflection, innovation, and student-centered education--work interdependently and are integral to developing teacher candidates who possess the necessary content knowledge, professional awareness, and professional dispositions to support and enhance the education of all students in all contexts.

***Content*** – The professional educator will know the subject matter to be taught to P-12 learners.

***Learner*** – The professional educator will understand P-12 learners’ socialization, growth and development; the learning process; reflection of teaching; and the establishment of a classroom climate that facilitates learning.

***Pedagogy*** – The professional educator will attain an understanding of the strategies that candidates use to teach all learners.

***Technology*** – The professional educator uses technology as a vehicle for learners to acquire information, practice skills, use higher order thinking skills, and participate in collaborative projects.

***Reflection*** – The professional educator exhibits the ability to reflect and assess his/her own effectiveness, and to systematically make adjustments to improve and strengthen areas needing attention.

***Dispositions*** – The professional educator demonstrates respect for learner differences, commitment to own personal growth, and engagement in short and long-term planning.

***Diversity*** – The professional educator is aware of and sensitive to diversity issues and to use culturally and socially responsive pedagogy.

**Professional Dispositions**

1. **Professional:**

• Follow the New York State Code of Ethics

• Maintain confidentiality

• Exhibit professional pride in appearance and demeanor

• Demonstrate high quality communication skills in both written and oral communications

1. **Reliable and Dependable:**

• Are punctual and organized

• Complete essential tasks without prompting

• Meet deadlines

1. **Respectful:**

• Committed to meeting student needs

• Practice judicious and empathetic interactions with students and colleagues on campus and in the community

• Show care and thoughtfulness in using the intellectual and physical property of others

1. **Committed to Student Learning:**

• Make decisions and plans that are student centered and foster higher-order thinking skills

• Demonstrate understanding of the important contribution of diversity of thought, background and ethnicity in high-quality educational experiences

• Use culturally-relevant curricula

• Demonstrate and affirm the expectation that all students can learn, and it is the teacher’s responsibility to investigate research and practice in differentiating instruction to reach all learners’ needs

• Display in their lessons and plans a thorough knowledge of current theory, content, pedagogy, technology tools and assessment practices

1. **Reflective:**

• Show an openness to continuous improvement

• Listen effectively

• Demonstrate receptivity to feedback by improving performance

• Tailor and reformat instruction based on assessed student needs

1. **Enthusiastic:**

• Show initiative and leadership

• Practice creative problem solving

• Demonstrate willingness to take calculated risks and to monitor students’ receptivity to teaching innovations

• Are energetic, and open to new ideas.

1. **Collaborative:**

• Work well with peers, faculty and mentors and seek to learn from them and share ideas

• Practice tactful communication skills, especially when sharing critique and constructive suggestions with others

• Seek appropriate leadership roles

**Course Objectives and Learning Outcomes**

A survey of the major conceptual ideas underlying the nature of matter, energy and mechanics. We will use minimal algebra and trigonometry appropriate for pre-service elementary teachers. This course will be taught using a variety of approaches including standard lecture, laboratory, intensive discourse and guided inquiry (constructivist inquiry) techniques. We will act as a scientific community to develop understandings of powerful scientific ideas underlying motion, forces, Newton's laws, work, energy and momentum. We will also study how K-8 students can come to learn about these same ideas. We will not formally distinguish between lecture and labs; you could have hands-on activities, discussions, lecture and problem-solving sessions any day. *In particular, you personally will be expected to demonstrate the general course objectives, particularly general course objectives 1-3 every week.*

General course objectives aligned with BSC Intellectual Foundations requirements for natural sciences courses include:

1. Describe the methods natural scientists use to explore natural phenomena, including observation, the framing of scientific questions, the development of hypotheses. measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis.

2. Apply natural science data, concepts, and models to natural science (critical thinking).

**Specific Student Learning Outcomes (College Senate Curriculum Committee approved) for PHY104:**

1. Design, perform and interpret experiments. Make, test and revise hypotheses and models, make observations and inferences. Construct and evaluate the quality of scientific explanations and models. *Participate in a discourse rich scientific community. Discuss the role of discourse and evidence in science.*

2. Use words (including physics terminology), simple arithmetic and diagrams to explain variety of physics phenomena. Apply physics concepts (e.g. motion, forces, energy transformations, static electricity, magnets and circuits) to predict behavior of practical systems.

3. Identify and discuss elements of *reformed science teaching* employed in this course, including student-student discourse, cooperative learning, reflective practice, role of prior knowledge in learning. Articulate and compare ideas before and after activities and analyze differences before and after learning sections of physics.

4. Analyze the learning experiences of children, their own learning process and compare these with the history of science.

**Course Content** (Activities and Procedures; College Senate Curriculum Committee approved) for PHY104:

I. NATURE OF SCIENCE

A. Primacy of observation

B. Role of creativity in science

C. Role of discourse and controversy in science

D. Role of hypotheses and models in science

E. Constructing scientific explanations

F. Criteria for evaluating scientific explanations (completeness, accuracy, support, logic, clarity)

II. INTERACTIONS AND ENERGY.

A. Kinetic energy

B. Energy diagrams

C. Energy transformations in contact interactions

D. Conservation of energy principle

III. INTERACTIONS AND FORCES

A. Motion with constant velocity

B. Speeding up and slowing down

C. Changing direction of motion

D. Combinations of forces

E. Motion with balanced forces

F. Children’s ideas about force

IV. INTERACTIONS AND SYSTEMS

A. Fields and potential energy

B. Interactions at a distance: static electricity, magnetism, gravitation

C. Air resistance and terminal velocity

V. MAGNETISM

A. Domain model for magnetism

B. Insufficiency of “charge” model for magnetism

C. Children’s ideas about magnetism

VI. ELECTRIC CIRCUITS *(time permitting)*

A. Energy transformations in circuits

B. Efficiency

C. Open, closed and short circuits

D. Parallel and series connections

VII. SCIENCE PEDAGOGY

A. Children’s ideas about physics topics (including force, magnetism, electricity, friction)

B. Prior knowledge

C. Classroom discourse

D. Parallels among children’s ideas, students’ ideas and the history of science

E. Reflective practice

**Evaluation**

**ATTENDANCE, HOMEWORK AND CLASS PARTICIPATION (20% OF GRADE):**

Attendance will be taken and is a significant part of your grade. You will be part of a working group that depends on every member’s input. You must be present for group discussions, and most discussions will only take place once and really can’t be made up later. Therefore, points will be deducted from your grade for each absence, excused or unexcused. Being late to class regularly will not be tolerated and the instructor will use his discretion to count lateness as an absence.

*Participation is crucial to this course, and you must develop the ability to both hear and listen to the ideas of your peers, to clearly communicate your own ideas, to negotiate how your ideas relate to those of your peers and to critically reflect upon how you construct scientific knowledge*. There will be approximately four to five separate activities per week worked into class. Homework and at-home activities will also be assigned and submitted to Blackboard. While you are strongly encouraged to work with others if you so choose, homework is expected to represent your own individual efforts, thoughts and language. Unexcused late homework will be discounted by 20-80% by date. Homework solutions will be posted or discussed, and used, in part, to construct midterm and final exams.

**Attendance**

Attendance will be taken and is a significant part of your grade. You will be part of a working group that depends on every member’s input. You must be present for group discussions, and most discussions will only take place once and really can’t be made up later. Therefore, points will be deducted from your grade for each absence, excused or unexcused. Being late to class regularly will not be tolerated and the instructor will use his discretion to count lateness as an absence.

**Individual or Group Video Project (15% of grade)**: More info to follow.

The final video should be a representation of your personal understanding about a topic of choice. It is a lengthy endeavor that showcases your ability to think deeply about a few related concepts covered during the course. Videos should be rich and dynamic, but heavily focused on projecting competence and understanding in relation to the chosen topic.

When selecting your topic, it is important to consider the kind of story you are able to tell along side your comfort with the material you will be presenting. Some topics will naturally lend themselves to video better than others and should be taken into consideration.

**EXTENSION QUIZZES (15% OF GRADE):** There are short (3-5 question) quizzes on Black Board to be done after the extension activities. These will help to review the activities and prepare for the tests.

**EXAMS (30% OF GRADE):** There will be at least three midterm exams and a final exam. Some conceptual and attitudinal assessments (graded on completeness only) may also be counted in this category.

**WRITTEN ASSIGNMENTS (20% OF GRADE):**

**Learning Commentaries** (Four): Double spaced full page essays will be written after reflecting upon the first three of the modules that make up this course. A learning commentary is a story describing the evolution of your thoughts on ONE scientific idea. You will describe your initial thoughts, activities, discussions that change or confirm how you think with examples and your final scientific idea. I will give more details in class, but in essence, you will write your learning commentary starting from your daily out the door reflection. Learning commentaries are graded based upon the quality and quantity of your comments and examples, together with how you support claims for having learned your final scientific idea with specific data taken from classroom observations and activities. In particular, I will be looking for:

o (5 points) A description of your ONE initial scientific idea based upon your previous life experiences,

 together with a description of your supporting evidence (with your original supporting evidence);

o (10 points) A substantive discussion of how various class discussions and activities promoted change

 in your idea (with examples and supporting evidence); and

o (5 points) A description of your final

 scientific idea.

**Expectations for Behavior and Procedures for Disruptive Individuals**

All candidates are expected to comport themselves in a manner that does not convey to others in the college community any disrespect, intolerance or rude behavior based upon age, race, religion, color, national origin, gender, sexual orientation, disability, or status – either marital, veteran or socioeconomic. All members of the college community are expected to contribute to the college environment and to move the college community toward respect for all. Buffalo State’s Compact for a Civil and Caring Academic Community provides insight related to these expectations and should be reviewed by each student. It can be found here: <https://deanofstudents.buffalostate.edu/compact-civil-and-caring-academic-community>

 In addition, by registering for courses, you have affirmed your willingness to abide by the Student Code of Conduct. It is available here for review <https://studentconduct.buffalostate.edu/student-code-conduct>

The college maintains a Code of Student Rights, Freedoms, and Responsibilities that governs the conduct of students on this campus. However, student misconduct that is disruptive in a manner that is harmful, verbally abusive, intimidating or intentionally interrupting for purposes of stopping a speaker, may result in a course of action outlined in the Handbook for Faculty and Librarians available here: <https://facultyhandbook.buffalostate.edu/disruptive-students>

**Cell Phone use During Class Policy**

Faculty can create their own policy based on their preference as some use cell phones for instructional purposes.

**Academic Dishonesty Policy**

Candidates who engage in plagiarism, cheating on examinations, submit the same work as other candidates, unauthorized collaboration, falsification and/or any other violation of academic integrity will receive an “E” grade in the course. Buffalo State has a campus wide license to *Turnitin* for unlimited submissions of student papers for plagiarism detection.

The [Academic Misconduct Policy](https://academicstandards.buffalostate.edu/misconduct): https://academicstandards.buffalostate.edu/misconduct and [procedures for academic misconduct](http://bscintra.buffalostate.edu/dops/policysect8/080400.pdf) are online at: http://bscintra.buffalostate.edu/dops/policysect8/080400.pdf. [An official explanation of what constitutes plagiarism and student resources](https://library.buffalostate.edu/c.php?g=773088&p=5546117) may be found at: https://library.buffalostate.edu/c.php?g=773088&p=5546117.

**Students with Disabilities**

Any student who requires accommodations to complete the requirements and expectations of this course because of a disability is invited to make his or her needs known to the instructor and to the director of the Student Accessibility Office, Twin Rise Center 120, 878-4500.‖

([Student Accessibility Services](file:///C%3A%5CUsers%5Cdelprapm%5CAppData%5CLocal%5CMicrosoft%5CWindows%5CTemporary%20Internet%20Files%5CContent.Outlook%5CZHP5DINO%5CStudent%20Accessibility%20Services): http://sas.buffalostate.edu/)

**Tutoring Services**

Buffalo State offers a wide array of free tutoring services. Check out the Academic Commons website for details: <http://academiccommons.buffalostate.edu/tutoring>.