FAIRMONT STATE UNIVERSITY™

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MEMORANDUM

TO: Faculty Senate

FROM: Dr. Susan Ross

DATE: April 7, 2021

SUBJECT: Curriculum Proposal #20-21-13

The Physics Program proposes to add a new physics course to the course catalog that has not been previously offered: a 4-credit hour core curriculum-level non-trig based physics course for any program which accepts a core curriculum-level or non-trig based physics course as a program prerequisite, and also for interested non-science majors. This new course has the same prerequisites as CHEM 1101 and will serve a similar role in the Physics Program. Laboratory experiments and classroom activities involving data collection and analysis will supplement the three hours of classroom lecture. Course content will follow the same outline as PHYS 1101, but with lower math and science background. Specifically, there is no Trigonometry pre-requisite.

cc: Richard Stephens
Lori Schoonmaker
Stephanie Gabor
Laura Ransom
Galen Hansen

PREPARING CURRICULUM PROPOSALS

INSTRUCTIONS

Draft your proposal in accordance with the guidelines below and the format shown on the following pages. Should any item under the several headings not pertain to your proposal, write N/A. **Number the second and subsequent pages of your proposal.**

Supply the preliminary information about the proposal as indicated below:

PROPOSAL NUMBER: Leave this space blank. A number will be assigned to the proposal by the Associate Provost.

SCHOOL: Enter the name of the College or School (e.g., *Liberal Arts*), Department (e.g., Language and Literature), and Program (e.g., English).

PREPARER/CONTACT PERSON: Enter the name of the person who prepared the proposal and his/her telephone extension number.

COPIES OF MEMOS SENT TO AFFECTED DEPARTMENTS: Attach these to the back of your proposal.

LETTERS OF SUPPORT FROM DEANS OF AFFECTED DEPARTMENTS: If the Curriculum Committee requests these letters, attach them to the back of your proposal.

DATE SUBMITTED: The Curriculum Committee meets on the fourth Tuesday of each month. **Proposals are due in the Office of the Associate Provost on or before the second Tuesday of the month.**

REVISION SUBMISSION DATE: If changes are required to the original proposal, enter the date the proposal was resubmitted.

IMPLEMENTATION DATE REQUESTED: Enter the first day of the semester (or summer term) and year in which the proposed curriculum change(s) would take effect.

CURRICULUM PROPOSAL (Submit one hard copy and an electronic copy to the Associate Provost by the second Tuesday of the month.)

Proposal Number:	#20-21-13
School/Department/Program:	College of Science and Technology/Natural Sciences Department/Physics Program
Preparer/Contact Person:	Galen Hansen
Telephone Extension:	X4716
Date Originally Submitted:	October 29, 2020
Revision (Indicate date and label it Revision #1, #2, etc.):	Rev1
Implementation Date Requested:	Fall 2021

I. **PROPOSAL**. Write a brief abstract, not exceeding 100 words, which describes the overall content of the proposal.

The Physics Program proposes to add a new physics course to the course catalog that has not been previously offered: a 4-credit hour core curriculum-level non-trig based physics course for any program which accepts a core curriculum-level or non-trig based physics course as a program prerequisite, and also for interested non-science majors. This new course has the same prerequisites as CHEM 1101 and will serve a similar role in the Physics Program. Laboratory experiments and classroom activities involving data collection and analysis will supplement the three hours of classroom lecture. Course content will follow the same outline as PHYS 1101, but with lower math and science background. Specifically, there is no Trigonometry pre-requisite.

A. Provision for interchangeable use of course(s) with program(s)

Core-Curriculum: new 4 credit course for Natural Science core-curriculum credit and program prerequisite requirements

B. Revision of course content. Include, as an appendix, a revised course description, written in complete sentences, suitable for use in the university catalog.

N/A

C. Other changes to existing courses such as changes to title, course number, and elective or required status.

N/A

D. Creation of new course(s). For each new course

1. Designate the course number, title, units of credit, prerequisites (if any), ownership (FSU or shared) and specify its status as an elective or required course. If you are creating a shared course, attach a memo from the Deans of the affected Schools explaining the rationale for the course being shared.

Course Number	Title	Credit	Prerequisites	Ownership	Status
PHYS 1001	General Physics 1	4	MATH 1507 or MATH 1530 or MATH 1407 or MATH 1430 or ACT Math 19 or new SAT Math score of 510 or ACCUPLACER QAS 250	FSU	Elective

2. Include, as an appendix, a course description, written in complete sentences, suitable for use in the college catalog.

   Please see Appendix A

3. Include, as an appendix, a detailed course outline consisting of at least two levels.

   Please see Appendix B

4. In order to meet the requirements as outlined in Goal One of the Strategic Plan, please include Outcome Competencies and Methods of Assessment as an appendix. Examples are available upon request from the Chair of the Curriculum Committee.

   Please see Appendix C

E. Attach an itemized summary of the present program(s) affected, if any, and of the proposed change(s).

Core-Curriculum – new 4 credit Natural Science course
Presently no programs are affected. However, in the future some programs may choose to use this course to meet prerequisite requirements rather than Physics 1101 which maintains a higher standard of math and content to meet present program requirements such as various science, science education and engineering technology programs.

Describe how this proposal affects the hours needed to complete this program. Specifically, what is the net gain or loss in hours? Use the format for Current and Proposed Programs in Appendix A.

N/A

II. RATIONALE FOR THE PROPOSAL.

A. **Quantitative Assessment**: This course has not been taught at FSU. There have been many requests over the years for a lower level physics course that could serve as a lab-based 4-credit core-curriculum physics course and as a prerequisite physics course for programs which require physics but for which a level of physics lower than the traditional Physics 1101, with lower algebra and no trigonometry prerequisites, is sufficient. The need for this course is also evidenced by the number of students (over 40 per year for the past several years) taking general physics courses (non-trig core-curriculum level) designed for the curriculum of programs such as 7-9 grade education and various health services, which are being transferred into FSU programs erroneously as trig-based prerequisite physics courses in place of Physics 1101, simply because Physics 1101 has also been approved as meeting core-curriculum credit requirements. Physics 1001 will now accept the transferred credit for these non-trig based courses. Programs wishing to accept non-trigonometry-based physics courses to meet their prerequisite physics requirements can do so by officially approving Physics 1001and such transferred courses in place of Physics 1101.

B. **Qualitative Assessment**: To attract students, the course content coverage will be about the same as Physics 1101, but with student learning outcomes set at a skill level about 50% of the quantitative capabilities and qualitative understanding of the present Physics 1101. Content assessment will involve about 30% multiple-choice qualitative questions that involve primarily memorization, about 20% multiple-choice questions that require some quantitative calculation, about 20% short-answer explanations, and

about 30 % simple 1-variable mathematical problem solving. Physics labs will be the same as Physics 1101, with comparable levels of hand-on data acquisition and computer analysis, but with lower expectations in mathematical analysis skill. Homework will also be set with a lower level of mathematics and critical thinking skills required.

This course provides a home for core-curriculum and non-trig based physics credit transferred from other institutions within and outside of West Virginia, such as general science and on-line physics courses, that does not meet higher program prerequisite requirements.

C. New materials needed to teach the lab are estimated to be about $200 per semester, which fits within the annual physics program budget. The same texted used for Physics 1101 will be used, but with a lower level of competency expected. A copy of the course textbook already exists in the library.

III. Should this proposal affect any course or program in another school, a memo must be sent to the Dean of each school impacted and a copy of the memo(s) must be included with this proposal. In addition, the Deans of the affected schools must sign below to indicate their notification of this proposal.

By signing here, you are indicating your college's/school's notification of this proposal.

College/School	Dean	Signature
Science and Technology	Steven Roof	Steven Roof

IV. Should this proposal affect any course to be added or deleted from the general studies requirements, a memo from the chair of the General Studies Committee indicating approval of the change must be included with this proposal.

V. ADDITIONAL COMMENTS.

The General Studies Committee has approved this course.

APPENDIX A – PHYS 1001
Course Description

This course introduces students without a trigonometry-based math and science background to general principles of motion and changes of motion by forces through the perspectives of Newton's Laws, Energy and Momentum. A three-hour laboratory period each week supplements the three lecture-recitation hours. Prerequisites are MATH 1507 or MATH 1530 or MATH 1407 or MATH 1430 or ACT Math 19 or new SAT Math score of 510 or ACCUPLACER QAS 250.

APPENDIX B
PHYS 1001 Course Outline

1. Scientific Tools
   a. Measurements, Units
   b. Models, Scales
   c. Uncertainty
   d. Vectors and scalars
2. Motion Along a Straight Line (1-D)
   a. Displacement and distance
   b. Velocity, Acceleration
   c. Kinematic Equations
3. Motion in A Plane (2-D)
   a. Displacement and distance
   b. Velocity, Acceleration
   c. Kinematic Equations
4. Newton's Laws of Motion
   a. Definition of Laws
   b. Multiple forces
   c. Net Force and acceleration
   d. Forces with angles
5. Uniform Circular Motion and Gravitation
   a. Centripetal acceleration
   b. Circumference, Angular velocity,
   c. Gravity as a centripetal force
6. Work and Energy
   a. Kinetic energy
   b. Work
   c. Work-Energy Theorem
   d. Potential energy
7. Rotational Motion
   a. Tangential velocity and acceleration
   b. Rotational Kinematic Equations
   c. Torque
   d. Equilibrium
8. Periodic Motion and Waves
   a. Springs and Hook's law
   b. Dynamic Equilibrium
   c. Tangential waves
   d. Longitudinal waves
9. Fluid Mechanics
   a. Pressure
   b. Pascal's Principle
   c. Archimedes' Principle
   d. Buoyancy
10. Temperature and Heat
   a. Temperature
   b. Thermal energy
   c. Heat, Phase changed

APPENDIX C
PHYS 1001 Course Competencies and Assessments

Physics Outcome 1. Students **will develop and** demonstrate a qualitative understanding of motion (linear and rotational), forces, laws of conservation; and to be able to apply this understanding to real-world settings. This includes meeting Core-Curriculum Course Outcome 1 below.

Physics Outcome 2. Students will develop and demonstrate analytical reasoning and quantitative problem-solving skills that allow mathematical analysis of physical systems in motion or in equilibrium using vector notation, one-variable algebra and geometry. Students should be able to analyze systems experiencing forces in one and two dimensions. This includes carefully reading the problem, converting the problem statement to an appropriate representation including pictures/graphs and the appropriate mathematical variables and relationships, and answering specified questions using proper logical and mathematical procedures. This includes meeting Core-Curriculum Course Outcomes 3 and 4 below.

Physics Outcome 3. Students will develop and demonstrate proficiency in collecting and recording observations, both verbally and as numerical data using laboratory equipment, and in quantitatively analyzing data to demonstrate physical principles, extract physical parameters, test and refine models (theories) using hypotheses, and answer pertinent questions. The students should also develop and demonstrate some understanding and proficiency in assessing the role of error and uncertainty in experimentation and scientific reasoning and problem-solving. This includes meeting Core-Curriculum Outcome 2 below.

Assessments: (See examples below for the Core-Curriculum assessments)

Content and utilization capabilities - written exams and quizzes.

Observation, data collection and analysis, and scientific modelling – laboratory activities and reports

PHYS 1001 Core-Curriculum Natural Science Outcome 8: Course Outcomes and Measures

Core-Curriculum Outcome 8: Students will demonstrate proficiency with scientific content and data analysis to address real world problems, and recognize the limitations of the scientific process.

Course Outcome 1. Students will demonstrate proficiency with the scientific content of General Physics, including retention and proper use of terms, definitions and concepts.

Assessments: written exams and quizzes. (See attached Test 1 as an example.)

Course Outcome 2. Students will demonstrate proficiency with data collection and observations using appropriate equipment and record-keeping during laboratory activities.

Assessment: Two labs with lab reports: (See attached labs and lab report instructions)
(a) "Projectile Motion" lab and report– "Procedure" section (setup and data collection)
(b) "Friction" lab and report – "Procedure" section (setup and data collection)

Course Outcome 3. Students will demonstrate proficiency with analysis of data using their proficiency with scientific content and data collection by applying the results of their data observations and analysis to address real world problems.

Assessment: Two labs and lab reports: (See attached labs and lab report instructions)
(a) "Projectile Motion" lab and report – "Data Analysis" section
(b) "Friction" lab and report – "Data Analysis" section

Course Outcome 4. Students will demonstrate recognition of the success and limitations of the scientific process by testing the accuracy of their data analysis and reflecting on the limitations and uncertainty of scientific modeling of nature, data-gathering and analysis.

Assessments: Two labs and lab reports: (See attached labs and lab report instructions)
(a) "Projectile Motion" lab and report – "Conclusions and Reflections", including set of questions.
(b) "Friction" lab and report – "Conclusions and Reflections", including set of questions

Assessment Rubrics

Outcomes	Assessments		Measured Goals
1. Scientific Content	Tests, quizzes	3 Tests, multiple quizzes	70% > 65%
2. Data Collection	Lab: **Projectile Motion** "Experimental" section of lab report	10 pts. Students receive full credit if they: *Describe properly the relevant parameters a to be measured and their relationship within equations to determine the velocity of the ball and the height of the hoop; *Properly measure the relevant parameters & record data for determining velocity of the ball and the height of the hoop.	80% of students receive 8/10 pts or higher
	Lab: **Friction** "Experimental" section of lab report	10 pts. Students receive full credit if they *Describe the relevant parameters to be measured to determine the coefficient of static and kinetic friction of a block on a track. *Properly collect and record data of the force of tension on the force transducer as a function of mass on the block.	80% of students receive 8/10 pts or higher
3. Data Analysis & Application to Real-world Problems	Lab: **Projectile Motion** "Introduction" and "Analysis" sections of lab report.	10 pts. Students receive full credit if they: *Properly describe the relevant relationships necessary to properly use the collected data to calculate the velocity of the ball and the height of the hoop; *Properly analyze the collected data using relevant relationships and parameters and correctly position the hoop for successful placement of ball through the hoop.	70% of students receive 7/10 pts or higher
	Lab: **Friction** "Introduction" and "Analysis" sections of lab report.	10 pts. Students receive full credit if they: *Properly describe the relevant relationships necessary to properly use the collected data to calculate the coefficient of static and kinetic friction of a block on a track. *Properly analyze the collected data using relevant relationships and parameters and correctly calculate the coefficient of static and kinetic friction of a block on a track.	70% of students receive 7/10 pts or higher
4. Science Limitations	Lab: **Projectile Motion** 25 pts. - Answers to questions in the "Conclusions and Uncertainty" section of lab report.	5 pts. Students receive full credit if they can fully and correctly answer questions at the end of the lab report describing: *Their success in modeling nature by their data collection, analysis and testing as applied to achieving or missing the goal of shooting a ball through a rather small target. *Proper examination of the sources of errors and uncertainties of data the led to the	Total points divided by 5 70 of students will receive 4/5 points or higher

		success or failure of the goal to shoot the ball through the hoop of the first try.	
	Lab: **Friction** 25 pts. - Answers to "Conclusions and Uncertainty" section of lab report.	5 pts. Students receive full credit if they can fully and correctly answer questions at the end of the lab report describing: *Their success in modeling nature by their data collection, analysis and testing as applied to the limitations of determining and using calculated coefficients of static and kinetic friction. *Proper examination the sources of errors and limitations of the data and the theoretical modeling of friction.	Total points divided by 5 70 of students will receive 4/5 points or higher