09-11h

LSC Use Only No:	LSC Action-Date:	UWUCC USE Only No.	UWUCC Action-Date:	Senate Action
		Date: 08-94h.	App - 11/10/09	App-12/1/09

Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person	Email Address
W. Larry Freeman	wlf@iup.edu
Proposing Department/Unit	Phone
Department of Physics	724-357-2370

Check all appropriate lines and complete information as requested. Use a separate cover sheet for each course proposal and for each program proposal.

1. Course Proposals (check all that apply)

____X__New Course _____Course Prefix Change _____Course Deletion

_____Course Revision _____Course Number and/or Title Change _____Catalog Description Change

	PHYS 441/541 Classical Mechanics
***Current* Course prefix, number and full title**	***Proposed* course prefix, number and full title, if changing**

2. Additional Course Designations: check if appropriate

_____ This course is also proposed as a Liberal Studies Course.

_____ This course is also proposed as an Honors College Course.

_____ Other: (e.g., Women's Studies, Pan-African)

3. Program Proposals

_____Catalog Description Change _____Program Revision

_____New Degree Program _____Program Title Change _____Other

_____New Minor Program _____New Track

***Current* program name**	***Proposed* program name, if changing**

4. Approvals		**Date**
Department Curriculum Committee Chair(s)		4/6/09
Department Chair(s)		4/6/09
College Curriculum Committee Chair		04/06/09
College Dean		04/06/09
Director of Liberal Studies *		
Director of Honors College *		
Provost *		
Additional signatures as appropriate: (include title)		
UWUCC Co-Chairs	Gail S. Sechrist	11/10/09

• where applicable

Liberal Studies
Received
APR 06 2009

Part II: SYLLABUS OF RECORD

PHYS 441/541 Classical Mechanics

I. Catalog Description

PHYS 441 Classical Mechanics 3c-0l-3cr
Prerequisites: PHYS 131, 132, MATH 125, 126
Co-requisite: MATH 241 or permission of the physics department

Covers vectors, generalized coordinates, and, coordinate-transformations to study the mechanics of a particle, and a system of particles in one, two, and three dimensions. Central forces, planetary, and satellite motion, rotation, oscillations, and conservation laws in the Newtonian formulation of classical mechanics will be included. In addition the Lagrangian formulation of classical mechanics will be developed and used to solve dynamical problems for various mechanical systems.

II. Course Outcomes

Upon successful completion of this course students should be able to:

1. Apply the standard methods of differentiation and integration to solve traditional dynamical problems in physics – gain sufficient practice to use them in more advanced situations. *(PDE standards for K-12 students 3.4.12.C)* Key assessment items based upon this concept
2. Perform kinematic analysis of both single and multi-particle systems in different coordinate systems (rectangular, polar, cylindrical and spherical) under constant and explicitly time-dependent forces. *(PDE standards for K-12 students 3.4.12.C)*
3. Explain the projectile motion of an object from an energy viewpoint; setup equations of motion of falling bodies under the influence of gravity and a drag force. *(PDE standards for K-12 students 3.4.12.C)* Key assessment items based upon this concept
4. Perform rotational kinematic analysis using the angular momentum and torque relationship; rotation of a rigid body about an arbitrary axis; dynamical balancing *(PDE standards for K-12 students 3.4.12.C)*
5. Explain the dynamics of oscillating systems; vibrational modes of coupled harmonic oscillators using accepted methods *(PDE standards for K-12 students 3.4.12.C)*

Course Outcome	College Conceptual Framework / Danielson	PDE program guide for Physics 7-12 certification	INTASC standard	NCATE/NSTA Standards	Course assessment measuring outcomes
1	1	1B	1	1a,1b,1c,1d,1e,2a,2b	**Tests & homework**
2	1	1B	1	1a,1b,1c,1d,1e,2a,2b	Tests & homework
3	1	1B	1	1a,1b,1c,1d,1e,2a,2b	**Tests & homework**
4	1	1B	1	1a,1b,1c,1d,1e,2a,2b	Tests & homework
5	1	1B	1	1a,1b,1c,1d,1e,2a,2b	Tests & homework

III. Detailed Course Outline

i. Fundamental Concepts (6 academic hours)

A. Reference Systems
   1) measure of space and time (units)
   2) definition of a vector
   3) properties of vectors
   4) coordinate transformations
   5) accelerated reference systems and relative motion

B. Vector analysis
   1) scalar product
   2) vector product

3) unit vectors
4) velocity and acceleration in various coordinates systems
5) gradient operator

ii. Newtonian Mechanics (18 academic hours)

A. Newton's laws
1) inertia, momentum, and force
2) general motion of a particle in a resisting medium
3) motion of a projectile in a resisting medium
4) motion with variable mass

B. Conservation Laws
1) single particle
a) linear momentum
b) angular momentum
c) work and energy

2) system of particles
a) rotational motion
b) of center of mass
c) moment of inertia
d) linear momentum
e) angular momentum
f) work and energy

C. Central Forces
1) Universal law of Gravitation
2) field vector
3) gravitational potential and potential energy

D. Forces in Accelerated Frames of Reference
1) inertial forces
2) non-inertial forces

iii. Oscillations (8 academic hours)

A. Linear Oscillations
1) simple harmonic oscillator
2) damped oscillations
a) mechanical
b) electrical

B. Forced Oscillations
1) sinusoidal driving force
2) transient effects
3) driven electrical oscillations
4) Fourier series

iv. Hamilton's Principle (8 academic hours)

A. The calculus of variations
1) generalized coordinates
2) conjugate coordinates

B. Lagrange's equations of motion
1) derivation using Hamilton's Principle
2) applications

Two exams (2 academic hours)

Final Exam (2 academic hours)

IV. Evaluation Methods

The final grades for the course will be based upon the following:

50% Exams. A minimum of two fifty minute in-class examinations consisting of problem solutions or essay exercises.

25% One two-hour final examinations

25% Homework and class participation. Students are expected to participate in the classroom discussions.

V. Example Grading Scale

A	90%-100%
B	80%-89%
C	70%-79%
D	60%-69%
F	less than 69%

VI. Required Textbooks

Potential Textbooks include but are not limited to:

Analytical Mechanics, Taylor, University Science Books, Sausalito, CA, 2005
Analytical Mechanics 6th ed., G. R. Fowles and G. L. Cassiday, Brooks-Cole, Toronto, 1999

VII. Attendance Policy

Attendance and enforcement thereof shall be in accord with the general guidelines provided in the official university "Undergraudate Course Attendance Policy".

VIII. Special Resource Requirements

Scientific calculator, Textbook, Notebook, paper, pen or pencil. No laboratory fee.

IX. Bibliography

1. Mechanics, K. R. Symon, Addison-Wesley Publishing Co., Inc., Reading, Massachusetts, 1953
2. Introduction to Theoretical Mechanics, R. A. Becker, McGraw-Hill Book Company, Inc., New York, Toronto, Canada, London, UK, 1954
3. Mechanics, Heat, Sound 2nd ed., F. W. Sears, Addison-Wesley Publishing Co., Inc, Reading, Massachusetts, 19xx
4. Physics, D. Halliday, R. Resnick, John Wiley & Sons, New York, London, Sydney,1960
5. Introduction to Classical Mechanics 2nd ed., A. P. Arya, Prentice Hall, 1998
6. Classical Mechanics, D. Morin, Cambridge University Press, Cambridge, UK, 2008

Course Analysis Questionnaire

Section A: Details of the Course

A1 How does this course fit into the programs of the department? For what students is the course designed? (majors, students in other majors, liberal studies) **The proposed course will replace the existing PHYS 222 and PHYS 223 – a two semester sequence for a total of four credit hours which covers intermediate and advances levels. Both semesters are not currently suitable or required for all the physics department programs and as a result it is impossible to insure adequate enrollment in both courses every year. The course is required by all physics majors but may be attended by anyone who meets the prerequisites.** Explain why this content cannot be incorporated into an existing course. **The proposed course is part of a major curriculum revision proposed by the Department of Physics. The proposed course will replace the existing course sequence and provide three credit hours instead of four. The content has been modified to present the most essential components at the intermediate level along with selected components at the advanced level.**

A2 Does this course require changes in the content of existing courses or requirements for a program? If catalog descriptions of other courses or department programs must be changed as a result of the adoption of this course, please submit as separate proposals all other changes in courses and/or program requirements. **No changes in the catalog descriptions of other courses or the requirements therein are necessary. This course is part of a curriculum revision (enclosed).**

A3 Has this course ever been offered at IUP on a trial basis (e.g. as a special topic) If so, explain the details of the offering (semester/year and number of students). **The proposed course has never been offered.**

A4 Is this course to be a dual-level course? If so, please note that the graduate approval occurs after the undergraduate. **The proposed course will be a dual level course.**

A5 If this course may be taken for variable credit, what criteria will be used to relate the credits to the learning experience of each student? Who will make this determination and by what procedures? **This course is a fixed credit course.**

A6 Do other higher education institutions currently offer this course? If so, please list examples (institution, course title). **Most higher learning schools offer similar courses: Appalachian State University, PHY 3010 Classical Mechanics, Clarion University, PH 351 Mechanics and Dynamics**

A7 Is the content, or are the skills, of the proposed course recommended or required by a professional society, accrediting authority, law or other external agency? If so, please provide documentation. **No, there is no accrediting agency or organization for Physicists**

Section B: Interdisciplinary Implications

B1 Will this course be taught by instructors from more than one department? **No.** If so, explain the teaching plan, its rationale, and how the team will adhere to the syllabus of record.

B2 What is the relationship between the content of this course and the content of courses offered by other departments? Summarize your discussions (with other departments) concerning the proposed changes and indicate how any conflicts have been resolved. Please attach relevant memoranda from these departments that clarify their attitudes toward the proposed change(s). **N/A**

B3 Will this course be cross-listed with other departments? If so, please summarize the department representatives' discussions concerning the course and indicate how consistency will be maintained across departments. **N/A**

Section C: Implementation

C1 Are faculty resources adequate? **Resources are adequate.** If you are not requesting or have not been authorized to hire additional faculty, demonstrate how this course will fit into the schedule(s) of current faculty. What will be taught less frequently or in fewer sections to make this possible? **The proposed course will replace PHYS 222 and PHYS 223 which are being eliminated as part of a major curriculum revision.** Please specify how preparation and equated workload will be assigned for this course. **There will be no change from the current process in assignment of workloads.**

C2 What other resources will be needed to teach this course and how adequate are the current resources? **No additional resources are required.** If not adequate, what plans exist for achieving adequacy? Reply in terms of the following:

*Space
*Equipment
*Laboratory Supplies and other Consumable Goods
*Library Materials
*Travel Funds

C3 Are any of the resources for this course funded by a grant? **No.** If so, what provisions have been made to continue support for this course once the grant has expired? (Attach letters of support from Dean, Provost, etc.)

C4 How frequently do you expect this course to be offered? **This course is expected to be offered each year.** Is this course particularly designed for or restricted to certain seasonal semesters? **Yes, since this course is a prerequisite for all advanced physics courses it is essential that it be taught each year in the Fall Semester.**

C5 How many sections of this course do you anticipate offering in any single semester? **One section**

C6 How many students do you plan to accommodate in a section of this course? **It is planned to accommodate 15 students.** What is the justification for this planned number of students? **All physics majors will be required to take this course and since the course is dual level all incoming graduate students will also be required to take the course under a graduate course number and section identifier.**

C7 Does any professional society recommend enrollment limits or parameters for a course of this nature? **No.** If they do, please quote from the appropriate documents.

C8 If this course is a distance education course, see the Implementation of Distance Education Agreement and the Undergraduate Distance Education Review Form in Appendix D and respond to the questions listed. **N/A**

Section D: Miscellaneous

Include any additional information valuable to those reviewing this new course proposal.

Appendix for Graduate course

I. Catalog description

PHYS 541 Classical Mechanics 3c-0l-3cr

Prerequisites: permission of the physics department

Covers vectors, generalized coordinates, coordinate transformations to study the mechanics of a particle, and system of particles in one, two, and three dimensions. Central forces including planetary and satellite motion, rotation, oscillations, wave motion and conservation laws. Derivation of Lagrange's equations to solve dynamical problems.

II. Course Outcomes

Upon successful completion of this course students should be able to:

1. Apply the standard methods of differentiation and integration to solve traditional dynamical problems in physics gain sufficient practice to use them in more advanced situations.
2. Perform kinematic analysis of both single and multi-particle systems in different coordinate systems (rectangular, polar, cylindrical and spherical) under constant and explicitly time-dependent forces.
3. Explain the projectile motion of an object from an energy viewpoint; setup equations of motion of falling bodies under the influence of gravity and a drag force.
4. Perform rotational kinematic analysis using angular momentum and torque relationship; rotation of a rigid body about an arbitrary axis; dynamical balancing
5. Explain the dynamics of oscillating systems; vibrational modes of coupled harmonic oscillators using Lagrangian method.
6. Apply the techniques of classical mechanics to various research areas and topics prevalent in physics today.

III. Additional Material for Graduate students

Although graduate students receive the same number of credits as undergraduates additional work is required of all graduate students. The extra work may take the form of (i) additional assignments of more challenging problems, (ii) extra readings of original works of scholarship, (iii) extra computer-based problems.

Graduate students will be required to show a greater degree of analysis, synthesis and evaluation of knowledge as well as, in presenting their results, greater independence than undergraduates. The instructor will make final judgment on the quality of their work.

IV. Evaluation Methods

The final grades for the course will be based upon the following:

50% Exams. A minimum of two fifty-minute in-class examinations consisting of problem solutions or essay exercises. Graduate students will be assigned an extra problem above the undergraduate level.
25% one two-hour final examination - Graduate students will be given an extra problem or problems above the undergraduate level
25% Homework and class participation. Students are expected to participate in the classroom discussions. Graduate students will be assigned an extra problem above the undergraduate level.

V. Example Grading Scale

A	90%-100%
B	80%-89%
C	60%-79%
F	less than 60%