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Curriculum Proposal Cover Sheet - University-Wide Undergraduate Curriculum Committee

Contact Person **Majid Karimi**	Email Address karimi@iup.edu
Proposing Department/Unit **Physics Department**	Phone **7 - 2339**

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 451/551 Electricity and Magnetism
***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		04/07/09
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

Received
NOV 04 2009
Liberal Studies

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APR 06 2009
Liberal Studies

Part II: SYLLABUS OF RECORD

PHYS 451/551 Electricity & Magnetism

I. Catalog Description:

PHYS 451 Electricity and Magnetism 3c-01-3cr

Prerequisites: PHYS 131, 132, MATH 125, 126

Prerequisite or co-requisite: PHYS 441/541 or permission of department

Treats elements of vector analysis, electrostatics, special techniques for finding electric potential, electric field in matter, magnetostatics, magnetic field in matter, electrodynamics, Maxwell's equations, and electromagnetic waves at the calculus level.

II. Course Outcomes

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

1. Apply physical concepts and mathematical techniques in solving standard problems of potential, force, field, work and energy in electrostatics. *(PDE standards for K-12 students 3.4.12.A, 3.4.12.D)*
2. Demonstrate the use of techniques e.g., Laplace's Equations, the method of images, separation of variables, multipole expansion method to solve special problems on potential, field and distribution of charges on symmetrically shaped objects. *(PDE standards for K-12 students 3.4.12.A, 3.4.12.D)*
3. Analyze Maxwell's equations and apply them to problems of wave propagation in matter. *(PDE standards for K-12 students 3.4.12.A, 3.4.12.D)*

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

Course assessments **underlined in bold** are to be designated as key assessments

III. Course Outline:

1. Vector analysis (5 academic hours)
   a) Vector algebra
   b) Differential calculus
   c) Integral calculus
   d) Curvilinear coordinates
   e) Dirac Delta function
2. Electrostatics (5 academic hours)
   a) The electric field
   b) Divergence and curl of electrostatic field
   c) Electric potential
   d) Work and energy in electrostatics
   e) Conductors
3. Special techniques (5 academic hours)
   a) Laplace's equation
   b) The method of images

c) Separation of variables
d) Multipole expansion

4. Electric fields in matter (5 academic hours)
   a) Polarization
   b) The field of a polarized object
   c) The electric displacement
   d) Linear dielectrics

5. Exam I (1 academic hour)

6. Magnetostatics (5 academic hours)
   a) Magnetic fields
   b) Magnetic forces
   c) Currents/current densities
   d) Biot-Savart law
   e) Divergence and Curl of B
   f) Application of Ampere's law
   g) Magnetic vector potential
   h) Multipole Expansion of the vector potential

7. Magnetic fields in matter (4 academic hours)
   a) Magnetization
   b) The field of a magnetic object
   c) Ampere's law in magnetized materials
   d) Linear and nonlinear materials

8. Electrodynamics (5 academic hours)
   a) Electromotive force
   b) Electromagnetic induction
   c) Maxwell's equations

9. Exam II (1 academic hour)

10. Conservation laws/Electromagnetic waves (6 academic hours)
    a) Continuity equation and poynting vector
    b) Maxwell's equations
    c) Waves in 1D
    d) E&M waves in vacuum
    e) E&M waves in matter
    f) Absorption and dispersion
    g) Wave Guides

Final Exam

IV. Evaluation Methods

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

50% Tests: Two tests consisting of problems
25% Final Exam: One two-hour final exam
25% Homework and class participation: Students will be evaluated on the basis of their participation in class and completion of the assignments.

V. Example Grading Scale

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

VI. Potential textbooks*

Introduction to Electrodynamics, 3rd ed., David J. Griffiths, Prentice Hall, 1999
Electromagnetic Phenomena, 2nd ed., Lorrain, Corson, and Lorrain, W. H. Freeman and Company, 2000.

VII. Attendance Policy

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

VIII. Special Resource Requirements

Scientific calculator, Textbook, Notebook, Paper, Pen or Pencil. No laboratory fee.

IX. Bibliography*

1. Classical Electromagnetic Radiation, 3rd ed, Heald and Marion,Brooks/Cole, 1995.
2. Electromagnetic Fields, 2nd ed., Roald K. Wangsness, 1986.
3. Foundations of Electromagnetic Theory, 3rd ed., Reitz, Milford, and Christy, Addison Wesley, 1979.
4. Electromagnetic Theory, Daniel R. Frankl, Prentice Hall, 1986.
5. Classical Electromagnetic, Jack Vanderlinde, Theory, John Wiley & Sons, Inc., 1993.
6. Principles Of Physics, 4th ed., Raymond A. Serway and John W. Jewett, Saunders College Publishing, 2004.

*Note: these are the latest references on this topic – there is little change in basic electrometric theory, and due to the few numbers of text book copies sold, publishers infrequently offer new editions.

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). **This course will replace PHYS 322 and PHYS 323. The course is required by our undergraduate and graduate majors. It may also be taken by other students who satisfy the prerequisites.**

Explain why this content cannot be incorporated into an existing course. **This course is part of a major curriculum revision proposed by the physics department. The existing course is a two semester sequence for a total of four credit hours which covers intermediate and advanced levels. Currently, both semesters are not required by all the physics**

programs and as a result it is very difficult to offer both courses every year due to low enrollment. The proposed course will replace the current course sequence and provide three credit hours instead of four. The content has been modified to incorporate all the necessary and updated materials at an appropriate 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.
This course does not require changes in the content of existing courses, or catalog descriptions of other courses or department programs. 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). **No**

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

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? **The course is a fixed credit course**

A6 Do other higher education institutions currently offer this course? If so, please list examples (institution, course title).
Similar course is offered as a core requirement for the physics majors in almost all of the Colleges and universities. Penn State, PHYS 400 electricity & magnetism, Clarion University, PH 352 electricity and magnetism.

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 for physics programs. However, the content of the proposed course is an essential requirement for the physics majors to have a basic understanding of the subject and its applications to other areas.

Section B: Interdisciplinary Implications

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

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).
No equivalent course is offered by other departments

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.
No

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 322 and PHYS 323 which**

are being eliminated as a result of curriculum revisions. Please specify how preparation and equated workload will be assigned for this course.
There will be no change from the current process in assignments of workloads

C2 What other resources will be needed to teach this course and how adequate are the current resources? 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

No additional resources is required

C3 Are any of the resources for this course funded by a grant? 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.)
No

C4 How frequently do you expect this course to be offered? Is this course particularly designed for or restricted to certain seasonal semesters?
Every year

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

C6 How many students do you plan to accommodate in a section of this course? **We expect to have about 15 students.** What is the justification for this planned number of students?
This course is going to be a required course for all of our undergraduate majors. This course is also required to be taken by all of our graduate students due to its dual nature and because the corresponding graduate level course has not been offered for a long time due to low enrollment.

C7 Does any professional society recommend enrollment limits or parameters for a course of this nature? If they do, please quote from the appropriate documents.
N/A

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.
This course is not a distance education course

Section D: Miscellaneous

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

Appendix for Graduate Course

I. Catalog Description

PHYS 551 Electricity & Magnetism 3c-01-3cr

Prerequisite: permission of department

Treats at calculus level elements of vector analysis, electrostatics, special techniques for finding electric potential, electric field in matter, magnetostatics, magnetic field in matter, electrodynamics, Maxwell's equations, and electromagnetic waves.

II. Course Outcomes

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

1. Apply physical concepts and mathematical techniques in solving standard problems of potential, force, field, work and energy in electrostatics.
2. Demonstrate the use of techniques e.g., Laplace's Equations, the method of images, separation of variables, multipole expansion method to solve special problems on potential, field and distribution of charges on symmetrically shaped objects.
3. Analyze Maxwell's equations and apply them to problems of wave propagation in matter.
4. Demonstrate the application of the theory of the classroom to applications of real world phenomena.

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 and 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%