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CURRICULUM PROPOSAL COVER SHEET
University-Wide Undergraduate Curriculum Committee

I. CONTACT

Contact Person Dennis Whitson and W. Larry Freeman Phone 7-4593/4592

Department Physics

II. PROPOSAL TYPE (Check All Appropriate Lines)

X **COURSE** Phys II Elec-Optics
Suggested 20 character title

X New Course* PHYS 116 Physics II for Electro-Optics
Course Number and Full Title

____ Course Revision _____
Course Number and Full Title

____ Liberal Studies Approval + for new or existing course _____
Course Number and Full Title

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____ Course Deletion _____
Course Number and Full Title

____ Number and/or Title Change _____
Old Number and/or Full Old Title

_____
New Number and/or Full New Title

____ Course or Catalog Description Change _____
Course Number and Full Title

PROGRAM: _____ Major _____ Minor _____ Track

____ New Program* _____
Program Name

____ Program Revision* _____
Program Name

____ Program Deletion* _____
Program Name

____ Title Change _____
Old Program Name

_____
New Program Name

III. Approvals (signatures and date)

Kenneth E. Hershman 11/16/00
Department Curriculum Committee

Richard D. Roberts 11/16/00
Department Chair

01/12/01
College Curriculum Committee

John D. Ed 1/12/00
College Dean

1/16/01
*Provost (where applicable)

+Director of Liberal Studies (where applicable)

1993

Syllabus of Record for PHYS 116

I. Catalog Description

PHYS 116 Physics II for Electro-Optics

2 lecture hours
3 lab hours
3 credits
(2c-3l-3sh)

Prerequisite: PHYS 115

By applying Newton's Laws of Motion to atoms and molecules the student is introduced to the basic principles of and connections between temperature, heat, and molecular motion at a fundamental level. Concepts involved in fluid flow, electric charge, and the origin of magnetism will be covered. The fundamental basis for the existence of electric and magnetic fields and the generation of electromagnetic energy as waves will be explored. This course includes a lab component.

II. Course Objectives

Upon successful completion of this course, the student will be able to:

1. Converse in the language of physics related to the motion of molecules and their relationship to temperature and heat.
2. Discuss the connections between the motion of charges and the existence of magnetic fields and in some cases develop theories from first principles, definitions, and laboratory observations.
3. Convert written or described physical word problems into a specific symbolic set of known and unknown physical parameters.
4. Solve for multiple unknowns in word problems using the known physical laws, free-body diagrams, trigonometry, algebra, and geometry.
5. Explain the Laws of Thermodynamics, Faraday's Law and Gauss' Law as well as Archimedes', Bernoulli's and Pascal's Principles and apply them, respectively, in solving problems related to heat, electromagnetic energy, and the motion of fluids.

III-A Course Outline for Lectures (28 hrs)

A. Fluids (3 hrs)
   1. Density and Flow Rate
   2. Steady Flow, Streamlines
   3. Pascal's Principle, Fluid Pressure
   4. Archimedes' Principle
   5. Bernoulli's Equation

B. Heat, Motion, and Temperature (3 hrs)
   1. The Ideal Gas
   2. The Temperature Scale
   3. Heat and Energy
      a. Thermal Expansion
      b. Conduction of Heat
      c. Specific Heat
      d. Change of State

B. Thermodynamics (3 hrs)
   1. The First Law of Thermodynamics
   2. Heat Engines
   3. The Second Law of Thermodynamics
   4. Entropy

C. Electricity (4 hrs)
   1. Force and Electric Charge
      a. Electric Charge
      b. Coulombs Law
      c. Conservation of Charge
      d. Conductors and Insulators

   2. The Electric Field
      a. Electric Field Lines
      b. Electric Flux, Gauss' Law
      c. Conductors in an Electric Field

   3. Electrostatic Potential and Electric Potential Energy
      a. Electric Potential
      b. Equipotential Lines and Surfaces
      c. Energy of a System of Point Charges
      d. Capacitance and Capacitors

D. Charge Motion and Ohm's Law (4 hrs)
   1. Electric Current
   2. Resistance, Resistors, and Ohm's Law
   3. Resistivity of Materials
   4. Combined Resistances

E. Considerations of the Magnetic Force and its Origin (4 hrs)
   1. The Magnetic Force and Field
   2. Ampere's Law
   3. The Motion of Charges in a Magnetic Field
   4. Force on a Current Carrying Wire
   5. Torque on Current Carrying Wire Loop

F. Electromagnetic Induction (3 hrs)
   1. Motional Electromotive Force
   2. Faraday's and Lenz's Laws
   3. Inductance and Inductors
   4. Transformers
   5. Energy Stored in a Magnetic Field

G. Electromagnetic Energy and Waves (2 hrs)
   1. Induction of Magnetic Fields and Maxwell's Equations
   2. The Electromagnetic Wave, its Origin, and the Speed of Light
   3. Plane Electromagnetic Waves and Polarization
   4. Energy of Electromagnetic Waves

Testing (2 hrs)

III-B. Course Outline for Labs (14 labs, 3 hours per lab)

A. Introduction (1 lab)
B. Review of Measurement, Error and Graphing (1 lab)
C. Archimedes' and Pascal's Principles (1.5 labs)
D. Fluid Flow and the Exponential Process (1.5 labs)
E. Thermal Expansion and Specific Heat Capacity (2 labs)
F. The Electric Field and Electric Potential (1.5 labs)
G. Ohm's Law and Resistance Combinations (1.5 labs)
H. The Charging and Discharging of a Capacitor (1 lab)
I. The Wheatstone Bridge and Potentiometer as Null Methods of Measurement (2 labs)
J. Lab Practical: Students will be required to take and analyze some data from set-ups that are similar to those they worked with during the semester. (1 lab)

IV. Evaluation Methods

The final grade for the course will be determined as follows:

50% Tests. Three tests (two during the semester and the final) consisting of solving word problems and writing short essays.

20% Homework

20% The average of all laboratory work.

10% The average of all quizzes in the lecture on the textbook and supplemental assignments.

Grading Scale:
90-100% : A; 80-89% : B; 70-79%: C; 60-69% : D; below 60% F.

Attendance Policy: The attendance policy will conform to the University wide attendance criteria.

V. Required textbooks, supplemental books and readings

Textbook: Hecht E., *Physics: Algebra/Trig, 2nd*, Brooks/Cole, 1998

Supplemental Readings:

1. *The Physics Teacher* (Journal published by the American Association of Physics Teachers)
2. Handouts

VI. Special resource requirements

None

VII. Bibliography

1. Beiser, A., *Modern Technical Physics, 6th Ed.,* Addison Wesley, 1992
2. Cole, R., *So You Want to Take Physics*, Saunders College Publishing, 1993
3. Coletta, V. P, *College Physics*, Mosby Year-Book, Inc., 1995
4. Katz-Stone, D. M. and Hubbard, K. A., *The Physics Toolbox*, McGraw Hill, 1998
5. McDermott, L. C., Shaffer, P. and the Physics Education Group, *Tutorials in Introductory Physics*, Prentice Hall, 1998
6. Ohanian, W., *Principles of Physics*, W. Norton & Co., 1994
7. Pickar, A. D., *Preparing for General Physics*, Addison Wesley Publishing Co., 1992
8. Romine, G.S., *Applied Physics: Concepts into Practive, 1st Ed.,* Prentice-Hall, 2001
9. Serway, *Principles of Physics, 2nd*, Saunders College Publishing, 1998
10. Wilson, J.D. and Buffa, A.J., *College Physics, 4th Ed.,* Prentice-Hall Academic, 1999.

Course Analysis Questionnaire
PHYS 116, Physics II for Electro-Optics

Section A: Details of the Course

A1 This course is a requirement for the proposed degrees Associate in Applied Science in Electro-Optics (A.A.S.E.O.) and Associate in Science in Electro-Optics (A.S.E.O.). This course is not intended for inclusion in the Liberal Studies program.

A2 This course does not require changes in any other courses in the department. The Applied Physics program will have an additional track associated with the A.S.E.O. degree and this course will be part of that track.

A3 This course has not been offered on a trial basis at IUP.

A4 This course is not intended to be dual level.

A5 This course is not to be taken for variable credit.

A6 Similar courses are offered at the following institutions:

1. Camden County College; Blackwood, New Jersey
   PHY-102 Physics II
2. Cincinnati Technical College; Cincinnati, Ohio
   PHY 2292 Physics 2
3. Indian Hills Community College; Ottumwa, Iowa
   EL 148V Technical Physics II
4. Monroe Community College; Rochester, New York
   PHY 231 Applied Physics III
5. Three Rivers Community / Technical College; Norwich, Connecticut
   PHY 120 Heat, Light, Sound

A7 As far as I know, the contents or skills of this proposed course are not recommended or required by a professional society, accrediting authority, law or other external agency. The content and/or skills of this course cannot be incorporated into an existing course. The material taught in this course is a subset of the material taught in PHYS 112 and PHYS 132. Geometric Optics, Wave Optics, and Electronics are not taught in PHYS 116 because this material is covered in detail in EOPT 110 (Geometric Optics), EOPT 120 (Wave Optics), and EOPT 125 (Introduction to Electronics). Because of this the subject matter in PHYS 116 has been altered and doesn't match the subject matter taught in PHYS 112 and PHYS 132.

Section B: Interdisciplinary Implications

B1 This course will be taught by one instructor.

B2 PHYS 116, Physics II, does not overlap any course taught in other departments.

B3 Seats will be available in this course for students in the School of Continuing Education.

Section C: Implementation

C1 The faculty resources are not adequate. In order to teach PHYS 116 for the Electro-Optics program, there is a need for 0.208 FTE. (For the source of this faculty resource see pg. 23 of "SSHE Requirements for New Programs".)

C2 Other Resources

a. Space
It is anticipated that a new building will be constructed at the North Pointe (Slate Lick) site before this program starts in the Fall of 2002. This building will house the Electro-Optics program. Since this course will be taught for the first time in the Fall of 2003 there should be no problem with space.

b. Equipment
In order to implement this course, we will need approximately $35,000 in the first year for hardware and software

c. Laboratory Supplies and other Consumable Goods
About $2,000 in the first year and about $2000 per year after that.

d. Library Materials
None anticipated since whatever books are purchased for PHYS 115, Physics I, will also cover the PHYS 116 material.

e. Travel Funds
None anticipated.

C3 No grant funds are associated with the maintenance of this course.

C4 This course will be offered once a year, usually in the Fall semester.

C5 One section of this course will be offered at a time.

C6 For the Electro-Optics program, twenty-four students will be accommodated in this course. Restrictions arise due to the available laboratory resources and exercises.

C7 There is no professional society that recommends enrollment limits or parameters for a course of this nature.

Section D: Miscellaneous

No additional information is necessary.