

New Course Request

Indiana University

South Bend

Campus

Check Appropriate Boxes:

Undergraduate credit

Graduate credit

Professional credit

1. School/Division CLAS 2. Academic Subject Code PHYS

3. Course Number P323 (must be cleared with University Registrar) 4. Instructor M. Lynker

5. Course Title Physics 3

Recommended Abbreviation (Optional) (limited to 32 Characters including spaces)

6. First time this course is to be offered (Semester/Year): Fall 2003

7. Credit Hours: Fixed at 3.0 or Variable from to

8. Is this course to be graded S-F (only)? Yes No X

9. Is variable title approval being requested? Yes No X

10. Course description (not to exceed 50 words) for Bulletin publication: Third semester of a four-semester sequence. Special relativity; introduction to quantum theory; Schroedinger equation; the hydrogen atom; many-electron atoms; statistical physics; molecules and solids.

11. Lecture Contact Hours: Fixed at 3.0 or Variable from to

12. Non-Lecture Contact Hours: Fixed at 0.0 or Variable from to

13. Estimated enrollment: 10 of which 0 percent are expected to be graduate students.

14. Frequency of scheduling: each Fall Will this course be required for majors? yes

15. Justification for new course: We wish to expand our modern physics coverage from one semester to two, in order to allow instruction in greater depth.

16. Are the necessary reading materials currently available in the appropriate library? yes

17. Please append a complete outline of the proposed course, and indicate instructor (if known), textbooks, and other materials.

18. If this course overlaps with existing courses, please explain with which courses it overlaps and whether this overlap is necessary, desirable, or unimportant. replaces PHYS P301 at South Bend campus -- see accompanying documents

19. A copy of every new course proposal must be submitted to departments, schools, or divisions in which there may be overlap of the new course with existing courses or areas of strong concern, with instructions that they send comments directly to the originating Curriculum Committee. Please append a list of departments, schools, or divisions thus consulted.

Submitted by:

Approved by:

[Signature] Date 11 Jan 2003 Department Chairman/Division Director

[Signature] Date 2/11/03 Dean

Date Dean of Graduate School (when required)

Date Chancellor/Vice-President

[Signature] 2/27/03 Senate Curr. Comm.

Date University Registrar

After School/Division approval, forward the last copy (without attachments) to the University Registrar for initial processing, and the remaining four copies and attachments to the Campus Chancellor or Vice-President.

Sample Syllabus

PHYS P323 – Physics 3 Indiana University South Bend

Instructor: Monika Lynker, Assoc. Prof. of Physics, NS343, 237-6513, mlynker@iusb.edu

Prerequisites: PHYS P222, MATH M216

Primary Text: Bernstein, Fishbane, and Gasiorowicz, *Modern Physics*, Prentice Hall, 2000. (or Thornton and Rex, *Modern Physics for Scientists and Engineers*, 2nd ed., Saunders, 2000; or Beiser, *Concepts of Modern Physics*, 5th ed., McGraw-Hill, 1995; or Serway, Moses, and Moyer, *Modern Physics*, 2nd ed., Harcourt, 1996)

Supplementary Texts: Taylor and Wheeler, *Spacetime Physics*, 2nd ed., W.H. Freeman & Co., 1992; Selected readings from *Scientific American*, *Physics Today*, *American Journal of Physics*

Objective: This is the first semester of a two-semester modern physics sequence, which will introduce students to the major developments of physics in the twentieth century. The principal topics for this semester include special relativity, wave-particle duality and quantum physics, including the historical development of quantum mechanics, statistical physics, molecular structure and excitations, and molecular bonding in solids.

Course Meetings: Two 75-minute meetings per week, a combination of lecture and activities that require active student participation.

Exams: Three exams, approximately equally spaced throughout the semester. The exams will include both computational and conceptual questions.

Homework Assignments: Homework assignments will be made regularly, approximately twelve assignments over the course of the semester. Problem assignments and due dates will be announced in class. *Discussion* of homework with your classmates is allowed; *copying* of homework is *not allowed*, and *both parties will be penalized*. Discussion of homework assignments with the instructor is, of course, *encouraged*. A penalty will be assessed for late homework, and homework assignments will not be accepted more than two class meetings after the due date.

Grading: The course grade will be determined from exam and homework scores as follows:

Exam average -- 80%

Homework average -- 20%

Topical Outline of the Course:

- I. Special Relativity
 - A. Basics of Special Relativity
 1. Historical Background – Michelson-Morley Experiment
 2. Review of Newtonian Coordinate and Velocity Transformations
 3. Einstein's Postulates
 4. The Lorentz Transformations
 - B. Relativistic Motion
 1. Time Dilation and Length Contraction
 2. Relativistic Velocity Addition
 3. Minkowski Diagrams
 4. The Invariant Interval
 5. Relativistic Doppler Shift
 - C. Relativistic Dynamics
 1. Relativistic Momentum
 2. Work and Energy
 3. Rest Energy
 4. Momentum-Energy Relationship
 6. Relativistic Collisions

- II. Quantum Theory
 - A. Experimental Basis
 1. Line Spectra
 2. Blackbody Radiation
 3. Photoelectric Effect
 4. X-ray Production
 5. Compton Effect
 6. Pair Annihilation and Creation
 - B. The Structure of Atoms
 1. Early Models of the Atom
 2. Rutherford Scattering and the Nuclear Atom
 3. The Bohr Model of the Hydrogen Atom
 4. Characteristic X-rays and the Moseley Plot
 - C. Early Quantum Theory
 1. Waves and Particles
 2. de Broglie Waves
 3. Electron Diffraction
 - D. Quantum Mechanics
 1. The Schroedinger Equation
 2. The Wave Function
 3. Expectation Values
 4. One-Dimensional Square Well Potentials
 5. Three-Dimensional Infinite Square Well Potential
 6. Harmonic Oscillator
 7. Tunneling
 - E. The Hydrogen Atom
 1. Separation of Variables
 2. Solution of the Radial Equation
 3. Solutions of the Angular and Azimuthal Equations

4. Quantum Numbers
 5. The Normal Zeeman Effect
 6. Spin
 7. Selection Rules and Probability Distribution Functions
- F. Many-Electron Atoms
1. The Periodic Table
 2. Spin-Orbit Interaction
 3. The Anomalous Zeeman Effect

III. Statistical Physics

- A. The Maxwell Distribution
- B. The Boltzmann Distribution
- C. Equipartition and Heat Capacity
- D. The Fermi-Dirac Distribution
- E. The Bose-Einstein Distribution
- F. Transition to the Continuum
- G. Systems of Relativistic Particles and the Blackbody Distribution

IV. Molecules and Solids

- A. Molecular Bonding and Spectra
 2. Molecular Rotation and Vibration
 3. Molecular Spectra
- B. Bonding in Solids
 1. Ionic Solids
 2. Covalent Crystals
 3. Metallic Solids
 4. Amorphous Solids