PHYSICS DEPARTMENT
COURSE OUTLINE

PHYS 215 INTRODUCTION TO QUANTUM PHYSICS

An introduction to selected topics in modern physics. Various topics include quantum theory of light; atomic structure; matter waves; quantum mechanics in one dimension; quantum mechanics in three dimensions.

OFFERED:	Winter
CREDIT:	4
IN-CLASS WORKLOAD:	4 lecture, 2 lab (semester)
PREREQUISITES:	Physics 200 and Math 220. *Math 253 recommended.*
COREQUISITES:	Math 225

REQUIRED MATERIALS:

Textbook: Modern Physics, 2nd edition, Serway, R.A., Moses, C.J. & Moyer, C.A.

Additional References: Physics for Scientists & Engineers with Modern Physics, 6th edition, Serway, .R.A. and Jewett, J.W.Jr.,

Supplementary material provided by instructor

Physics 200 lab manual

DEPARTMENT POLICIES REGARDING TESTING:

1. Students must write quizzes, tests, midterm tests, etc., on the date and time assigned by the instructor. Instructors are not required to provide make-up tests. At their discretion, instructors may waive a test or provide a make-up test only in the event of documented illness or other extenuating circumstances.

2. Midterm tests may be dropped if: (a) a first-class mark is obtained on the comprehensive final exam, and (b) all term work has been completed and is judged to be satisfactory. In this case, the final grade for the course may be based on a combination of the final exam and the lab mark.

DEPARTMENT POLICIES REGARDING LABS:

1. All assigned laboratory exercises and reports must be completed with an overall grade of 60% in order to obtain credit for this course. A lab may be waived or made up at a later time only in the case of documented illness or other extenuating circumstances.

2. A student who is repeating a Physics course does not have to complete the laboratory exercises a second time if an average lab grade of 70% or better was obtained.

STUDY TIME

It is recommended that between 5 and 10 hours per week (or more for students with a weak background) be spent studying for this course outside of class time.

GRADING

The standard mark distribution for this course is as follows:

Final Exam	50%
Midterms	30%
Lab Reports and other work	20%
	100%

This distribution may be amended by the instructor (see your Instructor's Information sheet).

GRADE SCALE

Final letter grades are normally assigned as follows (subject to above conditions):

Percentage	Letter Grade
95 to 100	A+
90 to 94	A
85 to 89	A-
80 to 84	B+
75 to 79	B
70 to 74	B-
65 to 69	C+
60 to 64	C
50 to 59	D
below 50	F

OUTLINE:

I. **Review of Wave Motion**

A. The wave equation
B. Superposition and interference

II. **Quantum Theory of Light (Text Chapter 2)**

A. Blackbody radiation
B. Photoelectric effect
C. Compton effect
D. Pair production

III. **Particle Nature of Matter (Text Chapter 3)**

A. Rutherford scattering
    1. Derivation of alpha particle scattering formula
    2. Derivation of Rutherford's scattering formula
B. Bohr atom
    1. Energy levels
    2. Spectra

IV. **Matter Waves (Text Chapter 4)**

A. de Broglie waves
B. Davison-Germer experiment
C. Wave packets
D. Heisenberg's uncertainty principle

V. **Quantum Mechanics in one dimension (Text Chapters 5 & 6)**

A. Postulates of quantum mechanics
B. Schroedinger's equation
    1. Time dependent form
    2. Time independent form
C. Particle in a box
    1. Energy levels
    2. Expectation values
    3. Probability density
D. Finite square well and harmonic oscillator
E. Barrier tunneling
    1. Transmission coefficient
    2. Square barrier

VI. **Quantum Mechanics in three dimensions (Text Chapter 7)**

A. Particle in a 3-D box
B. Schroedinger's equation for the Hydrogen atom
   1. Wave functions
   2. Radial probability density
   3. Quantum numbers
   4. Selection rules

VII. **Atomic Structure (Text Chapter 8)**

A. Zeeman effect
B. Spin
C. Pauli's exclusion principle
D. Periodic table

VIII. **Particle Physics (Text Chapter 15)**

A. Classification of particles
B. Four forces
C. Standard model