09-160

Curriculum Proposal Cover Sheet

course proposal and for

1. Course Proposal (check all that apply)

New Course Course Prefix Change Course Deletion

Director of

Part II: SYLLABUS OF RECORD

PHYS 461/561 – Quantum Mechanics I

I. Catalog Description

PHYS 473: Quantum Mechanics I 3c-01-3cr
Prerequisite: PHYS 331 and MATH 241

Quantum mechanics following methods of Schrodinger and Heisenberg; application to harmonic oscillator; three dimensional Schrodinger equation; hydrogen atom; electron in a magnetic field – normal and anomalous Zeeman effect; Spin.

II. Course Outcomes

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

- Solution of Schrodinger equation using polynomial method.
- Solution of Schrodinger equation using the operator method

5. Schrodinger Equation in Three Dimensions- Spherical Polar coordinates (8 academic hours)

- Separation of variables method
- Angular momentum and its components in differential forms.

- Angular momentum matrices.

6. The hydrogen Atom (7 academic hours)

- Solution of Schrodinger equation for the hydrogen atom.
- Derivation of azimuthal, polar, and radial wave functions.

- Principal, angular momentum, and magnetic quantum numbers.
- Energy schematics of the hydrogen atom.
- Normal Zeeman effect.

VIII. Special Resource Requirements

None

IX. Bibliography

1. Quantum Theory, David Bohm, Prentice-Hall, Inc., New York, 1951
2. Quantum Mechanics By John Powell and Bernd Crasemann, Addison Wesley Publishing Company, Reading, Massachusetts, 1961

3. Introduction to the Quantum Theory. David Park, McGraw Hill, 1964
4. Modern Physics & Quantum Mechanics, Elmer Anderson, W. B. Saunders Co., 1971.
5. Lectures on Quantum Mechanics By Gordon Baim, The Benjamin/Cummings Publishing Co, Reading, Massachusetts, 1978.
6. An Introduction to Quantum Physics By A. P French, W. W. Norton & Company, Inc, 1978
7. Understanding Quantum Physics By Michael Morrison, Prentice Hall, NJ, 1990
8. Quantum Mechanics By Amit Goswami, 2nd ed, Waveland Press, Inc, Long Grove, Illinois, 2003.
9. Quantum Physics 3rd edition By Stephen Gasiorowicz, John Wiley, 2003

10. Introduction to Quntum Mechanics, 2nd edition,, by David Griffiths, Pearson/Prentice Hall, NJ 2005.
11. Fundamentals of Quantum Mechanics By Sakin Erkoc, Taylor & Francis, New York

2.1 Gaussian Wave Packets
2.2 Application of The Uncertainty Principle To Gaussian Wave Packets
2.3 Group And Phase Velocities

3. Eigen Value Eigen Function Equation
3.1 Postulates of Quantum Mechanics
3.2 Linear Operators
3.3 Commuting operators
3.4 Hermitian Operators
3.5 The Momentum, The Kinetic Energy, and Position Operators
3.6 Measurement And Expectation Values

4. One Dimensional Quantum Mechanical Systems
4.1. Rigid Box Revisited
4.2 Finite square Potential Well
4.3 Square Barrier
4.4 Step potential

5. The Harmonic Oscillator
5.1 Solution of The Harmonic Oscillator Using The Polynomial Method
5.2 Dirac Bra and Ket notation
5.3 Position Representation
5.4 Solution of The Harmonic Oscillator Using Dirac's Notation

6. The Angular Momentum
6.1 The Eigenvalue Problem
6.2 Coordinate Transformation
6.3 Spherical Harmonics
6.4 The Operator Method
6.5 Angular Momentum Matrices
6.6 Raising And Lowering Angular Momentum Matrices

7. Central Potentials
7.1 Reduction of Two Body to One Body Problem

Appendix for Graduate Course

I. Catalog Description

[redacted]

Prerequisite: permission of the Physics Department

[redacted]

harmonic oscillator; three dimensional Schrodinger equation; hydrogen atom; electron in a magnetic field – normal and anomalous Zeeman effect; Spin.

II. Course Outcomes

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

[redacted]

Fr[redacted]ay, Apri 3, 2009 1:22 PM

Subject: PHYS 461
Date: Wednesday, April 1, 2009 1:11 PM
From: Marcy Rearick <MREARICK@iup.edu>
To: Stanley Sobolewski <sobolews@iup.edu>

Stan,
PHYS 461 is an available number.
Thanks for inquiring.

Marcy