Course Syllabus

Course Information

Course Number/Section	Physics 3352-501
Course Title	Modern Physics I
Term	Spring 07
Days & Times	TR 5:30 – 6:45 pm

Professor Contact Information

Professor	Anvar A. Zakhidov
Office Phone	(972) 883-6218
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Office Location	BE2.312
Office Hours	Tuesdays 4:30 -5:30

Professor	Roy C. Chaney
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Office Hours	Thursdays 4:30-5:30

Individual Project Assistant Contact Information

Project Assistant	*Rabia Moussa*
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Office Hours	TBA

Teaching Assistant Contact Information

TA	Gautam Hemani
Office Phone	(972) 883-2867
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Office Location	FO1.416
Office Hours	TBA

Course Pre-requisite

Phys 2303

Course Co-requisite

Phys 3311

Course Description

Topics include particlelike properties of radiation, wavelike properties of particles, old quantum theory, Schroedinger's Equation with solution to one dimensional problems, one electron atoms, spin, multielectron atoms and periodic chart.

Student Learning Objectives/Outcomes

This course is to introduce to students the basics of "Quantum Physics". Goal is to focus on explanation of how “old quantum physics” appeared and led to sophisticated “new quantum physics” and demonstrate how quantum mechanics plays a key role in understanding of the world of our experience, from microscopic objects, through nanoscience and all the way to macroscopic phenomena.

"Ideally", upon completion of the course, the instructor would like to see students being able to provide a qualitative explanation of the phenomena that a layman would understand, then give a more quantitative description using simplified models, and then perhaps indicate the ways how a more accurate knowledge could be derived.

Upon completing this course, students will:

1. Understand the wave and particle nature of light and microscopic particle systems.
2. Understand the electronic properties of multi-electron atoms and the concept of spin.
3. Understand how the chemical properties of atoms are affected by their electronic structure.

Required Textbooks and Materials

The basic material is covered in many textbooks and students may use any of them.

Still a basic required source is:

- R. Eisberg and R. Resnick, **"Quantum Physics of Atoms, Molecules, Solids, Nuclei, and Particles" Second Edition** (Wiley), Course will cover chapters 1-10

We will be also using illustrations and material from the International Bestseller:

J.P. McEvoy and Oscar Zarate **“Introducing Quantum Theory”** from the brilliant series of Introducing…guides by ICON BOOKS UK/TOTEM BOOKS USA

We would be tapping into other resources as well. We would particularly recommend an inexpensive books by

- R. A. Serway, C. J. Moses, C A. Moyer, **“Modern Physics”** Third Edition (Thompson/Brooks/Cole) which has modern type graphics, as compared to Eisberg, and
- W.A. Harrison, **"Applied Quantum Mechanics"** (World Scientific)

The instructors will try his best to make available on WebCT lecture notes and excerpts from resources that students do not have, particularly from “Introducing Quantum Theory” bestseller.

Assignments

The lectures will follow the basic textbook with additions from other 2 recommended books, presented to students in form of hard-copies of unfinished lecture notes, and also as electronic files at WebCT. During class students must add the equations and other materials presented on the black-board into the lecture notes.

HIGH-LEVEL DESCRIPTION OF THE COURSE

This brief description covers BASIC subjects of 10 Chapters, we will be talking about (in the same order as the chapters in main textbook). More detailed listings will be available with lecture notes.

1. THERMAL RADIATION AND PLAN'S POSTULATE

Thermal radiation; Classical Theory of cavity radiation; Plank's Theory of cavity radiation;

Plank's Postulate and Its implementations. A bit of Quantum History.

2. PHOTONS- PARTICLELIKE PROPERTIES OF RADIATION

The Photoelectric effect, Einstein's Quantum Theory of Photoelectric effect. The Compton Effect.

The Dual nature of Electromagnetic Radiation. Photons and X-Ray Radiation. Pair production and Pair Annihilation.Cross Sections for Photon Absorption and Scattering

4. **DE BROIGLE'S POSTULATE-WAVELIKE PROPERTIES OF PARTICLES**

Matter waves; The Wave-Particle Duality;

4. BOHR'S MODEL OF THE ATOM

5. SCRODINGER'S THEORY OF QUANTUM MECHANICS

6. SOLUTIONS OF TIME-INDEPENDENT SCHRODINGER EQUATIONS

7. ONE-ELECTRON ATOMS

8. MAGNETIC DIPOLE MOMENTS, SPIN, AND TRANSITION RATES

9. MULTIELECTRON ATOMS-GROUND STATES, X-RAY EXCITATIONS AND OPTICAL EXCITATIONS

10. TUNNELING PHENOMENA AND OTHER APPLICATON OF QUANTUM PHYSICS

IN NANODEVICES

The Square Barrier, barrier penetration. Some applications: Field emission of electrons,

Alfa-decay, The scanning tunneling microscope (STM)

Grading Policy

Final grades are determined from a combination of the following items:

1. **Homework** – homework assignment will be made at the start of each chapter. It will be due one week after the completion of the chapter. Graded homework and solutions will be returned within one week after it is assigned. Any homework turned in late will receive a reduced credit. No homework will be graded after solutions are distributed. The homework counts 25% of the final grade.
2. **Two examinations will be given.** The final examination will be the same as a regular examination and will not be comprehensive. The final will be at the regularly scheduled time, while the midterm will be announced at least one week before the exam. The midterm will count 30% of the grade, while the final will count 20%.
3. **Term Research Project** – is an individual topic/problem based on research on one of several topics provided to the class. A student would have an ample time to work on this research, using various resources with the final delivery in the form of a short paper and a presentation to the class. Paper of 10-15 pages length must be written and presented to class at end of term. Term project will count 25%.

Every attempt will be made to give students an opportunity to improve their standing. That includes the possibility of individual make-up tests at the end of the semester. A proactive student's position is encouraged and your feedback is always welcome.

The integrity of students' behavior matters - working in groups and using various materials is encouraged but it is the individual understanding of the subject and results that will be tested. All special student needs should be reported within first two weeks of the course. All questions about exam grades should be addressed the same week the grades become known.

Course Policies

Exams

Calculators will be necessary for all exams. **Graphing calculators and programmable calculators will not be allowed in the exams**. A little scientific calculator that has trig functions is all that is used on the exams.

All exams will be **open book**. **Exams will cover both in-class examples and homework**.

Any question about an exam grade must be addressed by the next class day after handing out of the exam to the class. After that all grades are final.

Homework

Homework assignments will be given in class.

Student Conduct & Discipline

The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UTD publication, *A to Z Guide*, which is provided to all registered students each academic year.

The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the *Rules and Regulations, Board of Regents, The University of Texas System, Part 1, Chapter VI, Section 3*, and in Title V, Rules on Student Services and Activities of the university's *Handbook of Operating Procedures*. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391).

A student at the university neither loses the rights nor escapes the responsibilities of citizenship. He or she is expected to obey federal, state, and local laws as well as the Regents' Rules, university regulations, and administrative rules. Students are subject to discipline for violating the standards of conduct whether such conduct takes place on or off campus, or whether civil or criminal penalties are also imposed for such conduct.

Academic Integrity

The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work.

Scholastic dishonesty includes, but is not limited to, statements, acts or omissions related to applications for enrollment or the award of a degree, and/or the submission as one's own work or material that is not one's own. As a general rule, scholastic dishonesty involves one of the following acts: cheating, plagiarism, collusion and/or falsifying academic records. Students suspected of academic dishonesty are subject to disciplinary proceedings.

Plagiarism, especially from the web, from portions of papers for other classes, and from any other source is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course will use the resources of turnitin.com, which searches the web for possible plagiarism and is over 90% effective.

Email Use

The University of Texas at Dallas recognizes the value and efficiency of communication between faculty/staff and students through electronic mail. At the same time, email raises some issues concerning security and the identity of each individual in an email exchange. The university encourages all official student email correspondence be sent only to a student's U.T. Dallas email address and that faculty and staff consider email from students official only if it originates from a UTD student account. This allows the university to maintain a high degree of confidence in the identity of all individual corresponding and the security of the transmitted information. UTD furnishes each student with a free email account that is to be used in all communication with university personnel. The Department of Information Resources at U.T. Dallas provides a method for students to have their U.T. Dallas mail forwarded to other accounts.

Withdrawal from Class

The administration of this institution has set deadlines for withdrawal of any college-level courses. These dates and times are published in that semester's course catalog. Administration procedures must be followed. It is the student's responsibility to handle withdrawal requirements from any class. In other words, I cannot drop or withdraw any student. You must do the proper paperwork to ensure that you will not receive a final grade of "F" in a course if you choose not to attend the class once you are enrolled.

Student Grievance Procedures

Procedures for student grievances are found in Title V, Rules on Student Services and Activities, of the university's *Handbook of Operating Procedures*.

In attempting to resolve any student grievance regarding grades, evaluations, or other fulfillments of academic responsibility, it is the obligation of the student first to make a serious effort to resolve the matter with the instructor, supervisor, administrator, or committee with whom the grievance originates (hereafter called "the respondent"). Individual faculty members retain primary responsibility for assigning grades and evaluations. If the matter cannot be resolved at that level, the grievance must be submitted in writing to the respondent with a copy of the respondent's School Dean. If the matter is not resolved by the written response provided by the respondent, the student may submit a written appeal to the School Dean. If the grievance is not resolved by the School Dean's decision, the student may make a written appeal to the Dean of Graduate or Undergraduate Education, and the deal will appoint and convene an Academic Appeals Panel. The decision of the Academic Appeals Panel is final. The results of the academic appeals process will be distributed to all involved parties.

Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations.

Incomplete Grade Policy

As per university policy, incomplete grades will be granted only for work unavoidably missed at the semester's end and only if 70% of the course work has been completed. An incomplete grade must be resolved within eight (8) weeks from the first day of the subsequent long semester. If the required work to complete the course and to remove the incomplete grade is not submitted by the specified deadline, the incomplete grade is changed automatically to a grade of **F**.

Disability Services

The goal of Disability Services is to provide students with disabilities educational opportunities equal to those of their non-disabled peers. Disability Services is located in room 1.610 in the Student Union. Office hours are Monday and Thursday, 8:30 a.m. to 6:30 p.m.; Tuesday and Wednesday, 8:30 a.m. to 7:30 p.m.; and Friday, 8:30 a.m. to 5:30 p.m.

The contact information for the Office of Disability Services is:

The University of Texas at Dallas, SU 22
PO Box 830688
Richardson, Texas 75083-0688
(972) 883-2098 (voice or TTY)

Essentially, the law requires that colleges and universities make those reasonable adjustments necessary to eliminate discrimination on the basis of disability. For example, it may be necessary to remove classroom prohibitions against tape recorders or animals (in the case of dog guides) for students who are blind. Occasionally an assignment requirement may be substituted (for example, a research paper versus an oral presentation for a student who is hearing impaired). Classes enrolled students with mobility impairments may have to be rescheduled in accessible facilities. The college or university may need to provide special services such as registration, note-taking, or mobility assistance.

It is the student's responsibility to notify his or her professors of the need for such an accommodation. Disability Services provides students with letters to present to faculty members to verify that the student has a disability and needs accommodations. Individuals requiring special accommodation should contact the professor after class or during office hours.

Religious Holy Days

The University of Texas at Dallas will excuse a student from class or other required activities for the travel to and observance of a religious holy day for a religion whose places of worship are exempt from property tax under Section 11.20, Tax Code, Texas Code Annotated.

The student is encouraged to notify the instructor or activity sponsor as soon as possible regarding the absence, preferably in advance of the assignment. The student, so excused, will be allowed to take the exam or complete the assignment within a reasonable time after the absence: a period equal to the length of the absence, up to a maximum of one week. A student who notifies the instructor and completes any missed exam or assignment may not be penalized for the absence. A student who fails to complete the exam or assignment within the prescribed period may receive a failing grade for that exam or assignment.

If a student or an instructor disagrees about the nature of the absence [i.e., for the purpose of observing a religious holy day] or if there is similar disagreement about whether the student has been given a reasonable time to complete any missed assignments or examinations, either the student or the instructor may request a ruling from the chief executive officer of the institution, or his or her designee. The chief executive officer or designee must take into account the legislative intent of TEC 51.911(b), and the student and instructor will abide by the decision of the chief executive officer or designee.

Off-Campus Instruction and Course Activities

Off-campus, out-of-state, and foreign instruction and activities are subject to state law and University policies and procedures regarding travel and risk-related activities. Information regarding these rules and regulations may be found at the website address given below. Additional information is available from the office of the school dean. (http://www.utdallas.edu/Business Affairs/Travel_Risk_Activities.htm)

These descriptions and timelines are subject to change at the discretion of the Professor.