**KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS**

**DEPARTMENT OF PHYSICS**

**Physics 212 Modern Physics - Spring Session 2018 - 2019 (Term 182)**

**Course Schedule and Grading Policy**

**Instructor :** Dr. Abdelkrim Mekki

**Office :** 6/219

**Telephone :** (013) 860 4292

**E-mail :** akmekki@kfupm.edu.sa

**Web page :** <http://faculty.kfupm.edu.sa/phys/akmekki>

**Lectures :** UTR 11:00 AM – 11:50 AM Room 6/166

**Laboratory :** W 02:10 PM – 4:50 PM Room 6/239

**Office Hours :** UTR 10:00 AM - 10:50 AM or by appointment Room 6/219

**Course Description:** An introductory course in Modern Physics. Topics covered include: Special Theory of Relativity; the Nuclear Atom; Electromagnetic Radiation; Bohr Theory of the atom; the Wave Nature of Matter; Quantum Mechanics in One and Three Dimensions; Atomic X-ray Spectra; Statistical Physics, selected topics in Atomic, Solid State, and Nuclear Physics.

**Pre-requisites:** PHYS 102 General Physics II

MATH 102 Calculus II

**Textbook :** "Modern Physics", by R. A. Serway, C. J. Moses and C. A. Moyer, 3nd Ed., Saunders College Publishing (2005).

**References :**

1) A. Baiser, Concepts of Modern Physics 6th Edition, McGraw-Hill, NY (2003).

2) R. T. Weinder and R. L. Sells, Elementary Modern Physics, 2nd Ed., Allyn and Bacon Inc., Boston (1980).

3) S. Thornton and A. Rex, Modern Physics for Scientists and Engineers, 4th Edition, Brooks/Cole (2013).

**Goals :** To introduce the students to the basic concepts of the major theories of the 20th century, namely the special theory of relativity, quantum and statistical mechanics and to discuss some selected topics in atomic, solid state, and nuclear physics.

**Grading Policy**: The course grade will be evaluated as follows:

**%age**

|  |  |
| --- | --- |
| **A+ ≥ 84** | **59 ≤ C ≤ 63** |
| **79 ≤ A ≤ 83** | **54 ≤ D+ ≤ 58** |
| **74 ≤ B+ ≤ 78** | **49 ≤ D ≤ 53** |
| **69 ≤ B ≤ 73** | **F ≤ 48** |
| **64 ≤ C+ ≤ 68** |  |

**Quizzes 10%**

**Laboratory 10%**

**Project 10%**

**Exam 1 20%**

**Exam 2 20%**

**Final exam 30%**

**Total 100%**

**Laboratory work**

The lab work score will be based on the lab reports. Check the lab schedule on the course website for the lab periods.

**Exams Schedule**

All exams will be of **problem solving type**. The exams are scheduled as follows:

**Exam 1 Sunday 17 February 2019 (Chapters 1-4)**

**Exam 2 Wednesday 27 March 2019 (Chapters 5-8)**

**Final Exam Tuesday 30 April 2019 (Comprehensive)**

**Policy on make-up exams**

If you miss a major exam, you should come and **see me** with your official excuse **within three days** after the exam. Personal excuses are not allowed. If you miss the exam without a valid excuse, you get a **ZERO** score for that exam.

**Attendance**: Attendance will be **enforced and evaluated** according to current university regulations. A **DN** grade will be given to any student exceeding 9 absences without official excuses and/or three absences in laboratory experiments. **Any student in possession of an excuse for officially authorized absence must present this excuse to me no later than one week following his resumption of class attendance.**

**Web page**

The course web page will provide key information during the semester. It will give the homework assignment, their due date and solution. The exams, homework, and lab grades will be published on the web site on regular basis. Any scheduling information that will change during the semester or important announcements will be posted on the web site and sent to the student by e-mail through Portal. Students are urged to check their e-mail as often as possible.

The applets related to a particular section of the course are imbedded in the lecture schedule. They are very helpful in visualizing some of the important concepts in the course

**Plagiarism and Cheating**: (Please read carefully)

This course is composed of both individual as well as group assignments.  It is important that your individual assignment be completed with your own efforts instead of copying it from your fellow student. KFUPM instructors follow “zero tolerance” approach with regard to cheating and plagiarism. During examinations (quizzes, major exams, lab reports) cheating or any attempt of cheating by use of illegal activities, techniques and forms of fraud will result in a grade of **F** in the course along with reporting the incident to the higher university administration.

Course learning outcomes:

At the end of this course the student should be able to:

1. Demonstrate knowledge in kinematic as well as dynamic special relativity.
2. Recall historic experiments that led to key discoveries in modern physics.
3. Know how and why quantum physics was introduced and the duality of light.
4. Know about the quantum nature of atoms.
5. Show mastery of the concept of wave nature of matter.
6. Solve problems related to quantum mechanics in one, two, and three dimensions.
7. Demonstrate mastery of the quantum theory of the hydrogen atom and hydrogen like atoms.
8. Have a strong knowledge about the various discoveries and experiments related to the discovery of the electron, protons, neutrons, and X-rays.
9. To show strong knowledge in quantum mechanics as applied to the field of statistical physics.
10. Conduct experiments, collect, and analyse data related to modern physics, and write concise reports.

**Physics 212 Lecture Schedule - Term 182**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Week** | **Date** | **Topics** | **Chap.** | **Sect.** |
| 1 | 60 Jan. 2019  08  10 | Introduction to the subject  Overview; The Principle of Relativity  Postulates of Special Relativity and Its Consequences The Lorentz Transformation | ---  1  1 | ---  1-3  4, 5 |
| 2 | 13  15  17 | **Problem solving chapter 1**  Relativistic Momentum, Newton Laws and Energy  Relativistic Mechanics + **Problem solving chapter 2** | 2  2 | 1, 2  3, 4 |
| 3 | 20  22  24 | Electromagnetic Waves and Blackbody radiation[Apple](http://www.watertown.k12.wi.us/hs/teachers/buescher/atomtime.asp)t1, [Applet](http://hyperphysics.phy-astr.gsu.edu/hbase/grexp.html#c1)  Planks Law, Rayleigh-Jeans Law, The Photoelectric Effect [Applet1](http://webphysics.davidson.edu/alumni/MiLee/java/bb_mjl.htm) , [Applet2](http://csep10.phys.utk.edu/guidry/java/planck/planck.html)  The Compton Effect and Particle Wave Complementarity | 3  3  3 | 1, 2  3, 4  5, 6 |
| 4 | 27  29  30 | **Problem solving chapter 3**  Atoms and Electrons The Rutherford Model[Applet](http://www.phys.virginia.edu/classes/109N/more_stuff/Applets/rutherford/rutherford.html)1, [Applet](http://micro.magnet.fsu.edu/electromag/java/rutherford/)2  The Bohr Atom [Applet1](http://lectureonline.cl.msu.edu/~mmp/kap29/Bohr/app.htm) , [Applet2](http://www.mhhe.com/physsci/astronomy/applets/Bohr/frame.html) | 4  4 | 1, 2  3 |
| 5 | 03 Feb.  05  07 | Bohr correspondence principle, Franck-Hertz Experiment [Applet](http://phys.educ.ksu.edu/vqm/free/FranckHertz.html)  **Problem solving chapter 4**  De Broglie Waves and Davisson-Germer Experiment[Applet](http://phet.colorado.edu/en/simulation/davisson-germer)1, [Applet2](http://hyperphysics.phy-astr.gsu.edu/hbase/davger.html) | 4  5 | 4, 5  1, 2 |
| 6 | 10  12  14 | Phase Velocity and Group Velocity of Waves [Applet](http://www.phys.ksu.edu/perg/vqm/tutorials/matterwaves/)1  The Heisenberg Uncertainty Principle  Particle-Wave Duality of the Electron [movie](http://www.youtube.com/watch?v=DfPeprQ7oGc) | 5  5  5 | 3  5  6, 7 |
| **Sunday 17 February 2019 – Exam 1 (Chapters 1 – 4)** | | | | |
| 7 | 17  19  21 | **Problem solving chapter 5**  The Born Probabilistic Interpretation [Applet1](http://www.colorado.edu/physics/2000/schroedinger/two-slit2.html) , [Applet2](http://www.colorado.edu/physics/2000/schroedinger/two-slit3.html)  The Schrodinger Equation for Particles [Applet](http://www.fen.bilkent.edu.tr/~yalabik/applets/1d.html) | 6  6 | 1  2, 3 |
| 8 | 24  26  28 | The Particle in a Box (One dimension)  The Finite square well  The Quantum Oscillator | 6  6  6 | 4  5  6 |
| 9 | 03 March  05  07 | Expectations Values, Operators and Observables  **Problem solving chapter 6**  The Square Barrier | 6  7 | 7, 8  1 |
| 10 | 10  12  14 | Barrier Penetration and Applications  **Problem solving chapter 7**  Particle in a Box (Three Dimensions) | 7  8 | 2  1 |
| 11 | 17  19  21 | Central Forces and Angular Momentum  Space Quantization, Quantization of angular momentum  Hydrogen-like Atoms, Selection Rules | 8  8  8 | 2  3, 4  5 |
| **Wednesday 27 March 2019 – Exam 2 (Chapters 5 – 8)** | | | | |
| 12 | 24  26  28 | **Problem solving chapter 8**  Orbital magnetism, Zeeman Effect, Electron Spin  The Spin-Orbit Interaction | 9  9 | 1, 2  3 |
| 13 | 31  02 April  04 | The Exclusion Principle  Screening Effects  The Periodic Table | 9  9  9 | 4  5  6 |
| 14 | 07  09  11 | X-ray Spectra and Moseley Law  **Problem solving chapter 9**  Statistical Physics, Maxwell-Boltzmann distribution | 9  10 | 7  1 |
| 15 | 14  16  18 | Conditions under which Maxwell-Boltzmann statistics are applicable  Quantum Statistics, Applications of Fermi-Dirac Statistics  **Problem solving chapter 10** | 10  10 | 2  3, 4,5 |
| **Tuesday 30 April 2019 - FINAL EXAM (COMPREHENSIVE)** | | | | |