The Petroleum Institute

Fall Semester 2010

PHYS341: Physics III – Modern Physics with Applications

Lectures	: One 50 minute, Three days per week
Credit hours	**:** 3
Text	: **Modern Physics for Scientists and Engineers, Third Edition** *by Stephen Thornton and Andrew Rex, Thomson Brooks/Cole*
Prerequisites	: PHYS241

Instructor:

Name	Dr. Kofi Agyeman
Office	8295
Phone Ext.	75016/75256
E-mail	kagyeman@pi.ac.ae
Classroom/ Time	8120 (13:00 -14:00) UTTh
Office Hours	• See schedule on office door • Also in Blackboard

Course Description

This course aims to instill in the student an appreciation of the concepts and methods of twentieth-century Physics, and to link this with insight into modern technological applications including lasers, light polarization techniques, radioactive dating, activation analysis, nuclear medicine, and semiconductor devices. The fundamental link between experiment and theory is stressed and discussed throughout and students will achieve a broader perspective about the empirical basis of modern Physics. Topics to be covered include the radiation and propagation of electromagnetic waves, the theory of special relativity, and the wave-particle duality of photons and 'material' particles.

Course Learning Objectives

After completing this course, you should be able to:

- Demonstrate an appreciation and understanding of the concepts and methods of 20th Century physics
- Demonstrate an insightful grasp of modern technological applications including lasers, electronic devices and atomic and nuclear techniques
- Demonstrate an understanding of how physical models develop and their limitations
- Apply problem solving skills to model and interpret experimental findings
- Communicate scientific ideas
- Identify and organize scientific, mathematical and technical information

Assessment

The final grade for this course will comprise the following five components:

Homework:	**10%**
Two Major Assignments:	**20%**
Two Tests:	**25%**
Mid Semester Exam:	**15%**
Final Exam:	**30%**
Total:	**100%**

Note 1: ***If one (or more) tests are missed and a documented excuse issued by the Student Affairs department is provided to explain the absence, then the final exam mark will be used for the missed test.***

If no suitable documented excuse is provided, then the test will be scored as zero

Note 2: ***No coursework mark will be discarded.***

The final letter grade will be assigned as follows:

Letter Grade	Marks	GPA
A	≥ 90.0	4.00
A-	87.5 → <90.0	3.75
B+	82.5 → <87.5	3.25
B	80.0 → <82.5	3.00
B-	77.5 → <80.0	2.75
C+	72.5 → <77.5	2.25
C	70.0 → <72.5	2.00
C-	67.5 → <70.0	1.75
D	60.0 → <67.5	1.00
F	< 60.0	0

Reading

Basic Text:

Modern Physics for Scientists and Engineers, Third Edition *by Stephen Thornton and Andrew Rex, Thomson Brooks/Cole*

Supplementary Reading

Physics for Scientists and Engineers by R A Serway; Saunders *(latest edition)*

Concepts of Modern Physics by A Beiser; McGraw-Hill *(latest edition).*

Attendance Policy

Students are expected to regularly attend lecture. Students who miss lectures are putting themselves and their classmates at a disadvantage; those who miss more than 20% of lectures are at significant risk of failing the course. Records of student attendance will be regularly reported to PI Student Affairs.

When absent, students may earn zero credit for missed quizzes or other graded in-class learning activities. Missed tests or midterm exams will be treated as described in the Assessment section of this syllabus.

Academic Integrity Policy

The Petroleum Institute is an academic community that is committed to principles of truth and academic honesty. Consequently it requires that we all uphold the highest standards of academic integrity. To this end, faculty and students must work to deter acts of academic dishonesty including cheating, fabrication or falsification, plagiarism, or any other act that aids or assists in these.

Toward this goal, each major assignment must include the *Honor Pledge*:

"I pledge that I have neither given nor received any unauthorized assistance on this assignment, exercise, or examination."

_____
(Student Signature)

Where the assignment is submitted as hard copy the pledge should be signed. Where the assignment is submitted electronically the inclusion of the pledge will count as a signature.

If an instructor suspects that a student has committed an academic offense, the instructor must (1) confront the student (2) make a determination (3) respond to the offence. If the student admits to the offence the instructor must impose a sanction and report the occurrence to the Academic Honor Council.

Please visit the following PI web site for further information and regulations regarding academic integrity: **http://www.pi.ac.ae/PI_STU/ro/pdf/2009-2010_UGCatalog_Oct8.pdf** (See page 25-29)

In case of EMERGENCY

Emergency Evacuation*: In case of an emergency or a fire alarm during a class, all students must follow the directions of the class/laboratory instructor and evacuate the room in an orderly manner to the assembly area. Failure to do so is a violation of PI's HSE Policy on emergency evacuation and will be subject to disciplinary action.*

Continuous assessment:

1. Homework

To learn physics well, it is imperative that students keep up with the subject matter by carefully reading the assigned chapters and making a serious attempt to do all of the assigned homework problems. Please note:

- In this course **some** homework will be assigned online. This will require students to have access to and use an Internet-connected computer. Online assignments are customized for each student so they require individual derivations and calculations.
- Up to two homework assignments per week may to be expected. Your lecturer will give you the due date for each homework assignment; failure to meet the deadline will result in zero credit.
- While collaboration and discussion is encouraged, heavy dependence on others will not help your understanding of the material taught and will result in poor performance on quizzes, tests and exams. Straight copying of the work of others is prohibited and will be penalized.
- It is very important that you read the section covered during the lectures. It is also helpful to derive all important expressions step by step. This helps your understanding a great deal.
- The sample problems offer you good opportunities to test your understanding while reading the text. There are many problems at the end of the chapters in your text of which only a fraction will be worked as examples in class. You may wish to work additional problems to gain more practice.

2. Class Tests

There will be **four** tests one of which will be the mid semester exam. Each test will be given after approximately three chapters (Refer to the lecture schedule on the next pages). **NO MAKE-UP TEST WILL BE GIVEN** for a missed class test. If you miss a scheduled class test and have a documented valid reason for missing the test, your final mark for the missed test(s) will come from the grade you score in the final examination.

3. Assignments

There will be up to three assignments, which could be associated with experiments in modern physics.

Lecture Schedule

PHYS341: Modern Physics and Applications
Fall Semester 2010

Target Schedule		***approx.***
Topic 1	**Wave/particle**; photoelectric effect Compton scattering, electron diffraction Uncertainty principle, wave packets	(Wks 1-2)
Topic 2	**Early atom**; evidence for structure Rutherford scattering. Bohr model X-rays, spectra and applications	(Wks 3-4)
Topic 3	**Wave mechanics**; matter waves Schrodinger equation, simple applications Hydrogen atom, quantum numbers	(Wks 4-5)
Topic 4	**Magnetic effects**; dipoles, electron spin Spectra, selection rules. Zeeman effect, doublets Lasers and applications	(Wks 5-6)
Topic 5	**Periodic table**; Heavy atoms, periodic table, exclusion principle Energy levels and spectra	(Wks 7-9)
Topic 6	**Solids**; molecular bonding, band theory Metals, insulators and conductors Applications and devices	(Wks 10-11)
Topic 7	**The nucleus**; structure, stability, binding Fission and fusion. Nuclear models Decay modes, half-life, decay series	(Wk 12)
Topic 8	**Nuclear techniques**; counting, spectroscopy Safety, exposure, dosage Nuclear power	(Wks 13-14)
Topic 9	**Special relativity**; clocks, reference frames Time dilation, length contraction Mass and energy	(Wks 15-16)