COURSE SPECIFICATION

Nuclear Physics II

Phys 482

2009

Course Specification

Institution: **King Khalid University**
College/Department **: Faculty of Science/ Department of Physics**

A Course Identification and General Information

1. Course title and code: **Nuclear Physics II ((Phys 482))**
2. Credit hours: **2**
3. Program(s) in which the course is offered. (If general elective available in many programs indicate this rather than list programs) **Physics**
4. Name of faculty member responsible for the course **Dr. Alaa Abd El-Hady**
5. Level/year at which this course is offered **: 8th level, Fourth year**
6. Pre-requisites for this course (if any) : **Nuclear Physics I ((Phys 481))**
7. Co-requisites for this course (if any): **----------**
8. Location if not on main campus: **Main Campus**

B Objectives

1. Summary of the main learning outcomes for students enrolled in the course.

This Course (Nuclear Physics II Phys 482) complements the Nuclear Physics I course. The course introduces students to the study of elementary particles and their interactions. The Course discusses the need for accelerators and detectors for the study of elementary particles (CERN, LHC, Fermi Lab etc). The students learn about quarks, leptons and gauge bosons. Electromagnetic, weak, and strong interactions are discussed at a suitable level. We discuss invariance principles and conservation laws. We also study quark structure of hadrons. Various phenomena related to high energy physics are discussed. By the end of the course, the student can have better understanding of the structure of matter, explain various phenomena at the subatomic level, and the cosmological level as well.

2. Briefly describe any plans for developing and improving the course that are being implemented. (eg increased use of IT or web based reference material, changes in content as a result of new research in the field)

The course website (on Blackboard) includes video lectures, pdf files of lectures, many others pictures, simulations, and videos illustrating various aspects of the course. It also includes a discussion forum to discuss questions, answers, and current scientific events.
The students are invited to visit the websites of various labs to learn more about accelerators, detectors and experiments and to watch online simulations.
Reference to current scientific events are emphasized (like the start of the LHC).

C. Course Description (Note: General description in the form to be used for the Bulletin or Handbook should be attached)

1 Topics to be Covered

Topic	No of weeks	Contact hours
1 Introduction to nuclear physics II, accelerators and detectors	1	2
2 Quarks and leptons: fermions, bosons, particles and antiparticles	1	2
3 Quarks and leptons: free particle wave equations	1	2
4 Quarks and leptons: quark flavours and lepton flavours	1	2
5 Interactions and fields: the Yukawa theory, Feynman diagrams	1	2
6 Interactions and fields: electromagnetic interaction	1	2
7 Interactions and fields: strong interaction	1	2
8 Interactions and fields: weak interaction	1	2
9 Invariance principles and conservation laws: translation, rotation	1	2
10 Invariance principles and conservation laws: CPT, isospin	1	2
11 Quarks in hadrons: charm and beauty; the heavy quarkonium states	1	2
12 Quarks in hadrons: the baryon decuplet, the baryon octet	1	2
13 Quarks in hadrons: the meson octet	1	2
14 Cosmology	1	2

2 Course components (total contact hours per semester): **28**			
Lecture: **28**	Tutorial: _____	Practical/Fieldwork/Internship:	Other: _____

3. Additional private study/learning hours expected for students per week. (this should be an average for the semester not a specific requirement in each week) **4 Hours**

4. Development of Learning Outcomes in Domains of Learning

For each of the domains of learning shown below indicate:

- A brief summary of the knowledge or skill the course is intended to develop;
- A description of the teaching strategies to be used in the course to develop that knowledge or skill;
- The methods of student assessment to be used in the course to evaluate learning outcomes in the domain concerned.

a. Knowledge

(i) Description of the knowledge to be acquired

Accelerators, Detectors. Mesons, Baryons, Quarks, Leptons, and Gauge Bosons. Fundamental Interactions (Electromagnetic, Weak, and Strong Interactions). Invariance principles and conservation laws. Quarks in hadrons. Introduction to Cosmology.

(ii) Teaching strategies to be used to develop that knowledge

Lectures, Group Discussions, Illustrations, Simulations, and Physics Websites.

(iii) Methods of assessment of knowledge acquired

Class questions, quizzes, and discussions.
Homework, and report.
Midterm exams and final exam .

b. Cognitive Skills

(i) Cognitive skills to be developed

Problem solving in physics.

Analysis of physical systems.

Mathematical skills of manipulating equations etc.

Physical meaning of equations, and physical terms etc.

Order of magnitude estimation.

Critical thinking.

(ii) Teaching strategies to be used to develop these cognitive skills

Lectures, Group Discussions, Illustrations, Simulations, and Websites.

(iii) Methods of assessment of students cognitive skills

Class questions, quizzes, and discussions.
Homework, and report.
Midterm exams and final exam .

c. Interpersonal Skills and Responsibility

(i) Description of the interpersonal skills and capacity to carry responsibility to be developed

Group and individual thinking and working.

(ii) Teaching strategies to be used to develop these skills and abilities

Group and individual discussions and projects.

(iii) Methods of assessment of students interpersonal skills and capacity to carry responsibility

Class discussions, homework, projects, and exams.

d. Communication, Information Technology and Numerical Skills

(i) Description of the skills to be developed in this domain.

Using computer for drawing graphs, doing calculations, and communications.

(ii) Teaching strategies to be used to develop these skills

Using software like Origin, Mathematica etc.

(iii) Methods of assessment of students numerical and communication skills

Written reports.

e. Psychomotor Skills (if applicable)

(i) Description of the psychomotor skills to be developed and the level of performance required

Not Applicable.

(ii) Teaching strategies to be used to develop these skills

Not Applicable.

(iii) Methods of assessment of students psychomotor skills

Not Applicable.

5. Schedule of Assessment Tasks for Students During the Semester			
Assessment	Assessment task (eg. essay, test, group project, examination etc.)	Week due	Proportion of Final Assessment
1	**1st Midterm exam**	**6th week**	**25%**
2	**2nd Midterm exam**	**12th week**	**25%**
3	**Final exam**	**Exam week**	**50%**

D. Student Support

1. Arrangements for availability of faculty for individual student consultations and academic advice. (include amount of time faculty are available each week)

10 office hours per week.

E Learning Resources

1. Required Text(s)

Introduction to High Energy Physics, Donald H. Perkins, Cambridge University Press; 4 edition (2000).

2. Essential References

Introductory Nuclear Physics, Kenneth S. Krane, John Wiley & Sons; 3rd edition (1987).

3- Recommended Books and Reference Material (Journals, Reports, etc) (Attach List)

The Particle Odyssey: A Journey to the Heart of Matter, Frank Close, Oxford University Press, USA (2002).

The Discovery of Subatomic Particles, Steven Weinberg, Cambridge University Press; 2 edition (2003).

4-.Electronic Materials, Web Sites etc

Websites of CERN, Fermi Lab etc.

5- Other learning material such as computer-based programs/CD, professional standards/regulations

Origin, Mathematica etc.

F. Facilities Required

Indicate requirements for the course including size of classrooms and laboratories (ie number of seats in classrooms and laboratories, extent of computer access etc.) **20 students maximum.** **Department computer lab for students with internet connection.** **Grader (teaching assistant) for homework.**
1. Accommodation (Lecture rooms, laboratories, etc.) **20 seat lecture room.**
2. Computing resources **Department computer lab for students with internet connection.**
3. Other resources (specify --eg. If specific laboratory equipment is required, list requirements or attach list) **Grader (teaching assistant) for homework.**

G Course Evaluation and Improvement Processes

1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching **Discussions with students.** **University course evaluation.**
2 Other Strategies for Evaluation of Teaching by the Instructor or by the Department **Discussions with students.** **University course evaluation.**
3 Processes for Improvement of Teaching **More knowledge about the course and the related recent scientific developments.** **More interaction with students.**
4. Processes for Verifying Standards of Student Achievement (eg. check marking by an independent faculty member of a sample of student work, periodic exchange and remarking of a sample of assignments with a faculty member in another institution) **Not Applicable.**
5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement. **Course evaluation is considered after the end of the semester.** **Students grades are discussed with the chairman of the department.** **Recent text books are consulted after the end of the semester.**