هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission
اعتماد
NCAAA
2024
TP-153

Course Specification
(Bachelor)

Course Title: :	**Nuclear Physics**
Course Code:	**PHY 1464**
Program:	**Bachelor of Science in Physics**
Department:	**Physics**
College:	**Science**
Institution:	**Imam Mohammad Ibn Saud Islamic University**
Version:	4
Last Revision Date:	***26/09/2024***

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☐University	☐ College	☒ Department	☐Track	☐Others
B.	☒ Required		☐Elective		
3. Level/year at which this course is offered: (Level 7/ Year 4)					
4. Course General Description:					
This course introduces basic nuclear physics, including nuclear decays and reactions and nuclear structure, while covering the essential areas of basic research and practical applications. It provides fundamental principles that underline nuclear science and its applications, as well as mathematical tools needed to grasp these concepts. Applications to nuclear science will be used to illustrate these principles. Discussions of theory are reinforced with examples which illustrate and apply the theoretical formulism, thus aiding students in their reading and analysis of current literature.					
5. Pre-requirements for this course (if any)**:**					
Quantum Mechanics (1), PHY 1312					
6. Co-requisites for this course (if any)**:**					
7. Course Main Objective(s):					

- **Learn and understand the basic properties of the nucleus.**
- **Understand the role of conservation laws in decay processes and reactions.**
- **Learn the principles of nuclear physics related to fission and fusion.**
- **Compare and construct different reaction mechanisms in relation to cross-sections, excitation functions, and angular distributions.**
- **Summarize and account for the main aspects of some applications of nuclear physics.**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	60	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**30**
2.	**Laboratory/Studio**	**0**
3.	**Field**	**0**
4.	**Tutorial**	**30**
5.	**Others (specify)**	**0**
Total		60

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	**Define and recall the basic nuclear concepts and nuclear properties.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Participation. ▪ Discussions.
1.2	**Describe the force between nucleons.**	**K1, K2**	• Lectures. • Tutorials. • Class discussions.	▪ Exams. ▪ Homework. ▪ Quizzes.
1.3	**Outline the main nuclear models.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
1.4	**Demonstrate basic knowledge of radioactive decay.**	**K1, K2**	• Lectures. • Class discussions. • Tutorials.	▪ Participation. ▪ Exams. ▪ Discussions. ▪ Homework.
2.0	**Skills**			

Code	Course Learning Outcomes	Code of PLOs aligned with the program	Teaching Strategies	Assessment Methods
2.1	**Explain and summarize the basic knowledge gained from studying the course.**	**S1, S2**	▪ Lectures. ▪ Class discussions. ▪ Tutorials.	▪ Exams. ▪ Discussions. ▪ Participation.
2.2	**Develop the students ability to solve and analyze problems in physics related the topics covered by the course.**	**S2, S3**	▪ Problem classes and group tutorial. ▪ Homework assignments as well as problems solutions.	▪ Exams. ▪ Discussions. ▪ Homework.
2.3	**Communicate in a clear and concise manner orally, and using IT for acquiring and analyzing information.**	**S4, S5**	• Lectures. • Class discussions. • Tutorials. • Encourage students to use electronic mail and internal network for submitting homework and assignments. • Use digital library.	▪ Exams. ▪ Participation and activities of students in the course community and blackboard. ▪ Homework.
3.0	**Values, autonomy, and responsibility.**			
3.1	**Show the collaboration and inter-professionalism in class discussions or team works, as well as solve problems independently.**	**V1, V2, V3**	• Small team tasks • Open discussion at classroom. • Office hours.	▪ Participation. ▪ Homework. ▪ Mini-project(s).

C. Course Content

No	List of Topics	Contact Hours
1.	**Basic Nuclear Concepts and Nuclear Properties:** History and overview, Some introductory terminology, Nuclear properties, Units and dimensions, The nuclear radius, Mass and abundance of nuclides, Nuclear binding energy, Nuclear angular momentum and parity, Nuclear electromagnetic moments.	**12**
2.	**The force between nucleons:** The deuteron, Proton-proton and neutron-neutron interactions, Properties of the nuclear force.	**12**
3.	**Nuclear Models:** The shell model, Even-Z, Even-N nuclei and collective structure.	**12**
4.	**Radioactive Decay:** The radioactive decay law, Production and decay of radioactivity, Growth of daughter activities, Types of decay, Natural radioactivity, Units for measuring radiation.	**12**
5.	**Nuclear Reactions:** Types of reactions and conservation laws, Energetics of nuclear reactions, Isospin, Reaction cross section, Experimental	**12**

	techniques, Coulomb scattering, Nuclear scattering, Direct reactions. Fusion and Fission.	
Total		**60**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	**Class Activities (class quizzes, homework, solving problems, etc.....)**	**weekly**	**10 %**
2.	**Midterm Exam 1**	**6thweek**	**25 %**
3.	**Midterm Exam 2**	**12thweek**	**25 %**
4.	**Final Exam**	**16thweek**	**40 %**

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	- Krane K.S., ***Introductory Nuclear Physics,*** Wiley (1988).
Supportive References	- Burcham W.E. and Jobes M., ***Nuclear and Particle Physics,*** 2nd Edition, John Wiley & Sons Inc (1995). - Knoll G.F., ***Radiation Detection and Measurements,*** 2nd Edition, Wiley (2010). - M Guran A. C and Zimmerman W.B., ***The Quantum World of Nuclear Physics,*** World Scientific (2005).
Electronic Materials	**https://units.imamu.edu.sa/colleges/en/science/Pages/default.aspx**
Other Learning Materials	

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**- Classrooms.** **- Labs.**
Technology equipment (projector, smart board, software)	**- Classroom equipped with a whiteboard and a projector.**
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	- Students - Second examiner	- Indirect (The students complete the evaluation forms at the end of term. Final exam is evaluated by the second examiner)
Effectiveness of Students assessment	- Instructors	- Direct (exams, HW, project, ...)
Quality of learning resources	- Faculty - Students	- Indirect (surveys)
The extent to which CLOs have been achieved	- Instructors - Program Leaders	- Direct (excel sheet)
Other		

Assessors (Students, Faculty, Program Leaders, Peer Reviewers, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Quality Unit-Physics Department
REFERENCE NO.	Department council No. 06
DATE	26/09/2024