Department of Physics

College of Education

University of Salahaddin-Erbil

Subject: Nuclear Physics Lab

Course Book: Year 4

Assist. Prof. Dr. Azad Muhammad Karem

Assist. Prof. Dr. Muhammad Mustafa

Assist. Prof. Dr. Habeeb Hanna Mansour

Assist. Prof. Dr. Hiwa Hamad Azeez

Mr. Govar Muayad Abdullah

Academic Year: 2022-2023

Course Book

1. Course name	Nuclear Physics Lab
2. Lecturer in charge	Hiwa Hamad Azeez
3. Department/ College	Physics/ College of Education
4. Contact	**E-mail:** hiwa.azeez@su.edu.krd hiwa.azeez@gmail.com
5. Time (in hours) per week	**Practical:** 1*2 = (2 Hours per week)
6. Office hours	I will be at my room on Monday from 8:30 Am to 01:00 PM.
7. Course code	
8. Teacher's academic profile	I graduated at college of Education/ Physics department in 2004. Got MSc at Salahaddin University-Erbil in 2010. I start teaching at college of Education as an assistant lecturer and worked at labs such as Advanced Electricity lab for two years and Nuclear physics lab in 2010. I also taught Modern physics for third year students, and Nuclear physics for fourth year students at college of education/ Sahqlawa in 2017. I reckon the best way to progress universities in Kurdistan is to let students to take part in English language courses before start studying at university.
9. Keywords	

10. Course overview:

The importance of nuclear physics lab is to let students to have practical information about nuclear radiation physics, Nuclear radiation detection, and see the instruments which are used in the nuclear labs. This module also provides better understanding of nuclear physics and number of topics in it and to have knowledge concerning some nuclear sources. They must make the differences between Particles, atoms and nuclear. To know something about nuclear radiation and to know the effect of radiation on human bodies.

11. Course objective:

The aim of this module is to provide students with

- Good understanding about nuclear radiation detection practically.
- To give information about nuclear radiation and affecting on human bodies.

- Understanding of the decay of some sources and why do they decay.
- To understand of detectors, how are they designed and how they work?
- To see how the gamma ray, alpha and beta particles generated and what is happening when they interact with human bodies.

12. Student's obligation

We have twelve experiments during the year. We explain the basic idea of the experiments in details including the equations and some solved problems. Then, for next week students are required to do experiments weekly during the course, this means each student takes an experiment, after doing experiments they prepare reports and submit it next week. Each report takes 10 marks (the way of doing experiments takes 3 marks, calculation and graphs take 4 M and discussion takes 3M). In case of a student misses an experiment and not bringing a report, they will be punished.

13. Forms of teaching:

A pamphlet is given to students which contains the method of doing experiments and some information concerning the experiments and references as well.

14. Assessment scheme

There are three ways of assessing. Firstly, students have to prepare reports every week which takes 10 marks. Secondly, a practical exam will be done after the whole semesters which take 10 Marks. Finally, final exam which is called theoretical over practical exam should be done at the end of second semester and this takes 30 marks.

Report 10%
Practical Exam 10%
Theoretical/Practical 30%

15. Student learning outcome:

After successful completion of the module, the students should have:

- Knowledge of Nuclear physics.
- Understanding of basic idea of Atoms and make the differences between particles, atoms and nuclear physics.
- Knowledge of Nuclear sources and how they decay?
- Understanding of detectors, why are they used ? and how they work?
- Understand the gamma ray, alpha and beta particles and make the differences between them.
- Learn how to protect their bodies from radiation.
- Knowledge of the statistical nature of radiation. etc

- Information about the effect of magnetic and electrical fields on the particles.

After successful completion of the module, the students should also be able to:

- Calculate statistical quantities.
- Measure the impulse counting rate as a function of distance between a source a counter tube.
- Evaluate attenuation coefficient for four absorbing materials.
- Measure the half – life of metastable Ba^{137}.
- Analyze the energy spectrum of gamma – ray.
- Measure the energy of Cs- 137.
- Evaluate the deflect of the beta radiation by magnetic.

Students are prepared to become school teachers at secondary or preparatory.

16. Course Reading List and References:

1. Nuclear science Experiments with digital Electronics.
2. "Cassy lab cataloge 2", 2013, by Michael Hund, Karl- Heinz, Timm, werner.

17. The Topics:	Lecturer's name
I don't have theoretical modules.	
18. Practical Topics (If there is any)	
First Semester: 1. Poisson's distribution and Gaussian distribution of radioactive decay. 2. Diffraction of β- particles in statically magnetic field. 3. Absorption coefficient for gamma rays. 4. Operating Plateau for the Geiger Tube. 5. Verification of Inverse square law for Gamma- Ray. **Second Semester:** 1. Spectrum analysis of some standard source using scintillation Detector and MCA. 2. The study of Compton scattering for gamma rays using MCA. 3. Foundation of material height in closed containers. 4. Determination of Operating Voltage for Scintillation Detector 5. Energy calibration of the scintillation detector and energy determination of the unknown gamma emitter source.	First semester: ex: (2 hrs per week) Weeks: 1. General Information will be given to students about nuclear physics 2. From week 2 to 6 experiments will be done. 3. Week 7 review of experiments. 4. Week 8 practical experiment. 5. Week 8 theoretical/

6. Determination of dead time (resolving time) of G.M. counters by two –source method. 7. Activity measurement of unknown source using rad lab.	practical exam will be done.

19. Examinations:

1. Compositional.
2. Calculations.
3. Derivation of laws.
4. Drawing.

20. Extra notes:

N/A

21. Peer review