

Ministry of Higher Education and Scientific research



Department of Physics

College of Education

University of Salahaddin

Subject: Solid State Nuclear Track Detectors

Course Book – *For MSc Physics Students*

Lecturer's name: Habeeb Hanna Mansour, PhD

Academic Year: 2023/2024- second semester

Course Book

1. Course name	Solid State Nuclear Track detectors
2. Lecturer in charge	Habeeb Hanna Mansour
3. Department/ College	Education College- Dept. of Physics
4. Contact	e-mail: mansourhabib48@yahoo.com , habeeb.mansour@su.edu.krd Tel:
5. Time (in hours) per week	3
6. Office hours	Wednesday 10:30AM-02:00PM , Thirstday 08:30AM-11:00AM in the my room., other timings I will be available in the . “ Advance Nuclear Lab” in College.
7. Course code	
8. Teacher's academic profile	<p><u>Educational Qualifications:</u></p> <p>B.Sc. In General Physics , Salahaddin University, College of Education, Department of Physics,1985.</p> <p>M.Sc. In Nuclear Physics, Salahaddin University ,College of Science, Department of Physics,1988.MSc Research Title : <u>Study of Fission Tracks In A Glass Detector And The Detector Characteristics For Measuring Neutron Flux 1988</u> . The thesis prepared under supervision Prof. Dr. D.S.SRIVASTAVA.(From India).</p> <p>Ph.D. In Nuclear Physics, Baghdad University , College Of Ebn-al-Haytham for Education , Department of Physics ,2000. Ph.D. Research Title <u>Design of Long-Tube Technique For Discrimination of Radon (Rn-222) From Thoron (Rn-220) In Building Materials and Soil Gas Using CN-85 Nuclear Track Detector. 2000</u> . The thesis prepared under supervision Prof. Dr.Shaker mahmud Al-Jabori. (From Iraqi Atomic Energy) and Prof. Dr. Muayyed G. Yousef (from Baghdad University College of Ebn-Alhaytham Education College.)</p> <p><u>Specialization :</u></p> <p>A- Experimental Nuclear Physics in the Field of Solid State Nuclear Track Detector at MSc Level.</p> <p>B-Experimental Nuclear Physics in the Field of Environmental Radioactive Pollution at PhD Level .</p> <p><u>Academic Degress</u></p> <p>2011Assis.Prof. of Nuclear Physics</p>

	<p>1994 Lecturer of Nuclear physics</p> <p>1989 Assistant lecturer</p> <p>1985 Demonstrator , Department of Physics, College of Education, Salahaddin University-Erbil Iraq.</p> <p>From 2002 to date, Supervisor of several undergraduate students projects ,and Supervising four M.Sc. Students in the field of environmental radiation pollution , physics department, College of Education, Salahaddin University- Erbil Iraq.</p> <p><u>MSc. Student Thesis Titles:</u></p> <p>1- Measurement of radon activity concentration in Iraqi-Kurdistan soil by CR-39 plastic track detectors 2004.</p> <p>2-Study of radon and thoron release from Iraqi- Kurdistan building materials using passive and active methods 2009.</p> <p>3-Calibration of diffusion cup for Long Term Radon Activity Concentration Measurement Using CR-39 Plastic Nuclear Track Detectors.2011.</p> <p>4-Radon-222 and Radium-226 Activity Concentration Measurement in Erbil Governorate Drinking Water Resources Using Active and Passive Detection Methods 2014.</p> <p>5- The Assessment of Radon (^{222}Rn) activity concentration in the Environment of Barsarin Village and its Effects on Human Health. 2022</p> <p>6-Health Assessment of Natural Radioactivity (U-238, Ra-226, Th-232 and K-40) and Radon (Rn-222) Exhalation Rate in Granites Used as Building Materials in Erbil Governorate Kurdistan Region-Iraq. 2023</p> <p><u>PhD student Thesis Titles :</u></p> <p>1-Natural Radioactivity and Dose Assessment in Plant Fertilizers Used In Iraqi Kurdistan Region and Its Environmental Impacts.2019</p> <p>2- The investigation of the level of radioactivity of the natural background radiation in the small Zab River Basin: (Taq Taq farms). 2022</p> <p><u>Main field of interest</u></p> <p>Is applied nuclear physics , with special reference to the</p>
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	<p>application and development of nuclear track detectors like glasses, plastics etc, in nuclear reactions , nuclear fission trace element, alpha radiography and analysis of uranium and thorium , measurement of environmental radiation and radon activity concentration using , gamma spectrometry (HPGe and NaI(Tl) , alpha spectrometry (RAD7) and Solid State nuclear track detectors.</p> <p><u>Details of Courses Taught for BSc and MSc Students:</u></p> <p>Modern Physics, Nuclear Physics, Nuclear Reactor Physics , Electrostatic ,Nuclear Detectors , Electromagnetic Theory, Advance of Electromagnetic Fields ,Advance Statistical Physics, Properties of Matter, Nuclear Tracks In Solids ,Nuclear Electronics , Health Physics, Classical Mechanics and Environmental Radiation ..</p> <p><u>Research Applications</u></p> <p>1- Habib.H.Mansour , N.T.Patto and A.z. Al-Abdin Fission fragment track detection characteristics of Iraqi Soda Lime glass detectors., J- College of Education, V.3,(1993), No.2 .</p> <p>2- Habib.H.Mansour , Radon measuring for the determination of uranium in Iraqi-Soda lime glass by track method ., J. College of education, V.3, 1993 No.4</p> <p>3- Habib.H.Mansour, Sherzad A.T. and S.R.hussen , Annealing of latent fission fragment tracks in Iraqi soda lime glass detector., J. College of Education,V.4, No.4,1993.</p> <p>4- Habib.H. M., S. per Khdar, H.Y. Abdulla, N.Q. Muhamad, M.M. Othman, S. Qader . Measurements of Indoor Radon levels in Erbil Capital Using Solid State Nuclear Track Detectors .Radiation Measurement 40 (2005) 544-547 www.ScienceDirect.com</p> <p>5-Habib H.M.," On Depleted Recycled Uranium and its Impact on Environment</p> <p>”Report Prepared During Visit to Abdus Salam International Centre for Theoretical Physics From 19th January to 8th April 2006.</p> <p>6- Asa’d H., Habib H. M ,Measurement of radon activity concentration in Iraqi- Kurdistan soil by using CR-39 plastic track detectors. Zanko J. of pure and applied sciences 2004.</p> <p>7-Habib H. M. Measurement of radon permeability through some commercial PVA- sponge . Zanco Journal of pure and applied sciences/ Salahaddin University –Hawler Vol. 19 No.3 2008.</p>
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	<p>8-Habib H.M. Measurement of Radium Concentration and Radon Exhalation Rate in Iraqi Kurdistan Rocks Type Limestone Using LR-115 Plastic Track Detectors. Zanko, J. of pure and applied sciences. Vol.22, No.3, 2010.</p> <p>9- Samal. S. Faki and Habib H. Mansour ,Calibration of a permeable cup provided with CR-39 nuclear track detectors for indoor radon activity concentration measurement , 4th ICOWOBAS-RAFSS 2013,JohorBahru,Malaysia,3-5September 2013.</p> <p>10- Hiwa H. Azeez , Samal S. Faki , & Habeeb H. Mansour , Radon Activity Concentration Measurement In Erbil Typical Schools. , 2nd International Conference on Ecology, Environment and Energy(ICEEE 2015), 12-13 April, 2015 by Ishik and Salahaddin Universities Erbil- Iraq.</p> <p>11- Hiwa H. Azeez and Habeeb H. Mansur,A Study of Radon Gase Release from Iraqi-Kurdistan Building Materials Using Passive and Active Methods. 2nd International Conference on Ecology, Environment and Energy(ICEEE 2015), 12-13 April, 2015 by Ishik and Salahaddin Universities Erbil- Iraq.</p> <p>12- Saman K. Ezzaddin , Habeeb H. Mansour and Hewa H. Azez , An Investigation of Activity concentration of ²³⁸U,²³²Th, ¹³⁷Cs and ⁴⁰K Radionuclides in Drinking water resources in Iraqi Kurdistan Region. Accepted for publication in Zanko Journal of Pure and Applied Sciences 2016.</p> <p>13- Ali H. Ahmed, Habeeb H. Mansour, Saman K. Ezzulddin, Ahmed I. Samad , Radon (²²²Rn) Content in Bottled Water of Kurdistan Region using Active and Passive Methods, Accepted for publication in Zanko Journal of Pure and Applied Sciences 2016.</p> <p>14- Saman K. Euzzaddin and Habeeb H. Mansour , Assessment of Radon Exposure in Erbil Drinking Water Resources, Zanko J.ournal of Pure and Applied Physics ZJPAS (2017), 29 (s4); s184.</p> <p>15- Hiwa H. Azeez ,Saddon T. Ahmad and Habeeb Hanna Mansour, Assessment of radioactivity levels and radiological-hazard indices in plant fertilizers used in Iraqi Kurdistan Region. Journal of Radio analytical and Nuclear Chemistry, September 2018, Volume 317, Issue 3, pp 1273–1283. https://link.springer.com/article/10.1007/s10967-018-6001-3</p> <p>16- Hiwa H. Azeez, Habeeb Hanna Mansour, S. T. Ahmad, Transfer of natural radioactive nuclides from soil to plant crops. Journal of Applied Radiation and Isotopes, Volume 147 May 2019, Pages 152-158. https://doi.org/10.1016/j.apradiso.2019.03.010</p>
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	<p>17- Hiwa H. Azeez¹, Habeeb Hanna Mansour, Saddon T. Ahmad, Effect of Using Chemical Fertilizers on Natural Radioactivity Levels in Agricultural Soil in the Iraqi Kurdistan Region <i>Pol. J. Environ. Stud. Vol. 29, No. 2 (2020), 1-10</i></p> <p>18- Saman Khabbat Ezzulddin · Habeeb Hanna Mansour, Radon and radium activity concentration measurement in drinking water resources in Kurdistan Region-Iraq. <i>Journal of Radioanalytical and Nuclear Chemistry (2020) 324:963–976.</i></p> <p>19- Jahfer M. Smail · Saddon T. Ahmad · Habeeb Hanna Mansour, Estimation of the natural radioactivity levels in the soil along the Little Zab River, Kurdistan Region in Iraq. <i>Journal of Radioanalytical and Nuclear Chemistry</i> https://doi.org/10.1007/s10967-021-08064-5</p> <p>20- Ari I Muhammad, Habeeb H. Mansour, ²²²Rn Activity Concentration Measurement and Its Radiological Risks in the Environment of Barserin Village, Erbil-Iraq. <i>Zanko Journal of Pure and Applied Science 2022.</i> https://doi.org/10.21271/ZJPAS.34.2.2.</p> <p>21- Hindreen R. Awlla, Habeeb H. Mansour, Evaluation of Radon (²²²Rn) Exhalation Rates from Imported Granite Tiles Used as a Building Materials in Erbil Governorate, Kurdistan Region -Iraq. <i>Zanko J.ournal of Pure and Applied Physics 2023.</i></p> <p>22-- Jahfer M. Smail ,Habeeb Hanna Mansour & Saddon T. Ahmad , Evaluation of radiological hazards in lower zab river sediments. Radiation Effects and Defects in Solids , Received 26 Apr 2023, Accepted 27 Jul 2023, Published online: 10 Aug 2023</p> <p><u>23</u>-Jahfer M. Smail, Hiwa H. Azeez, Habeeb H. Mansour and Saddon T. Ahmad, Radon Activity Concentration Measurements in the Water Collected from the Lower Zab River in the Kurdistan Region of Iraq. <i>ARO-The Scientific Journal of Koya University Vol. XI, No. 1I (2023), Article ID: ARO.11192. 08 pages Doi: 10.14500/aro.11192</i></p> <p>24-Hiwa Hamad Azeez, Jahfer Majeed Smail, Hemn Muhammad Salh, Habeeb Hanna Mansour, Saddon Taha Ahmad, Comparative Study Between Virgin and Agriculture Soil Radon Activity</p>
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	<p>Concentration and Their Radiological Risks. . https://doi.org/10.59341/2707-7799.18022707-7799/© 2024, Erbil Polytechnic University. This is an open access article under the CC BY-NC-ND 4.0 Licence (https://creativecommons.org/licenses/by-nc-nd/4.0/).</p> <p><u>Research Under Preparation</u></p> <p>1-Effects of Stirring on the Bulk Etch Rate of CN-85 Nuclear Plastic Track Detectors .</p> <p>2- Natural Radioactivity and the Radiation Dose Levels In Cigarettes Available In Iraqi Kurdistan Markets Using Passive and Active Methods.</p> <p>3- Assessment of Radiation Dose Due to Exposure to Radon in Different Café Rooms and Indoor Cigarette Smoking Using Solid State Nuclear Track Detectors.</p> <p>4- A Study of Seasonal Variation in Radon Concentrations in Iraqi Kurdistan Drinking Water Resources Using RAD7 Solid State Detector</p> <p><u>Membership of Professional Bodies</u></p> <p>Member of Iraqi Physics and Mathematics Society.</p> <p>Member of Iraqi-Kurdistan Physics Society</p> <p><u>Foreign research institutes visited</u></p> <p>ICTP -Trieste/ Italy , Elletra, Synchrotron Radiation , Padova , Ion beam accelerators , Trieste University/ Dept. of Physics</p>
9. Keywords	<p>Environment , Ionization Radiation , Non ionization radiation ,Radioactivity , Radiation Dose , Dosimeters , Radiation Protection , Radioisotope's , Gamma Ray , X-Ray , Alpha Particles , Beta Particles , Neutron , Environmental Isotopie's , Uranium , Thorium , Americium , Cobult-60 , strontium, uses of radioisotopes, nuclear reactors , radioactive west , NORM , radioactive therapy and diagnostic , biological effects, Radioactive pollution, Radiation Protection , Micro wave, Ultraviolet wave, ----- .</p>

10. Course overview:

This course deals with; nuclear track detectors, the nature of charged particle tracks, Track formation mechanism in insulating materials, Track Etching; Methodology and Geometry, Revelation and Visualization of Latent Tracks in Polymers and NTS Applications.

11. Course objective:

At the end of the course, the students should be able to:

- Discuss different kind of nuclear track detectors.
- Determine methods of track revelation and visualizations.
- Measure the charged particle tracks
- Applicate of NTS for radon and thoron gases detection.

12. Student's obligation

class activity +article review + Quiz +Seminar (5+10+5+10)	30%	
Midterm Exam.	20%	
Final Exam.	50%	
Total	100%	

13. Forms of teaching

Lectures will be given using data show and power point, by writing on the white board, and also on the chalk board

14. Assessment scheme

16. Course Reading List and References:

Textbooks:

A. Solid State Nuclear Track Detection Principles, Methods and Applications.
S.A Durrani , R.K Bull , 1987

Nuclear tracks in solids, principle and applications.
R.L Fleischer. P. Buford price, 1985

Radon Measurements by Etched Track Detectors, Application in Radiation Protection, Earth Sciences and the Environment. Saeed A. Durrani & Radomir Ilic, 1997

Thesis on Radon and thoron Detections. Education College Laboratory.

B- Programing

TRACK_TEST software, developed for alpha track calculation.

SRIM 2003, SRIM is a software package concerning the stopping and range of ions in matter.

C- Journals

Health physics.

Nuclear tracks and radiation measurements.

Nuclear instrument and radiation measurement.

Radiation physics and chemistry.

Radiation Measurements

17. The Topics:

Lecturer's
name

Ch.1 An over view on nuclear track in solids	6	
Ch.2 The nature of charged particle tracks and some possible track formation mechanisms in insulating solids	6	
Ch.3 Track etching; methodology and geometry	9	
Ch.4 Revelation and Visualization of Latent Tracks in Polymers	6	
Ch.5 Uses of Nuclear Track Detector for Radon Gas Measurement	6	
Ch.6 Recent nuclear Track Applications	6	
Total	36	
18. Practical Topics (If there is any)		
In this section The lecturer shall write titles of all practical topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture		Lecturer's name ex: (3-4 hrs) ex: 14/10/2015
19. Examinations		
Type of Examinations:		
1. Compositional:		

2. True or false type of exams:

3. Multiple choices:

20. Extra notes:

Here the lecturer shall write any note or comment that is not covered in this template and he/she wishes to enrich the course book with his/her valuable remarks.

21. Peer review

پیداچونہوہی ھاوہل

This course book has to be reviewed and signed by a peer. The peer approves the contents of your course book by writing few sentences in this section.

(A peer is person who has enough knowledge about the subject you are teaching, he/she has to be a professor, assistant professor, a lecturer or an expert in the field of your subject).

ئەم كۆرسىبووكە دەبىت لەلایەن ھاوھلېكى ئەكادېمىيە سەير بىكرىت و ناوھرۆكى بابەتەكانى كۆرسەكە پەسەند بىكات و جەند ووشەيەك بنووسىت لەسەر شىاوى ناوھرۆكى كۆرسەكە و واژووى لەسەر بىكات.
ھاوھل ئەو كەسەيە كە زانىارى ھەبىت لەسەر كۆرسەكە و دەبىت پلەى زانستى لە مامۇستا كەمتر نەبىت.