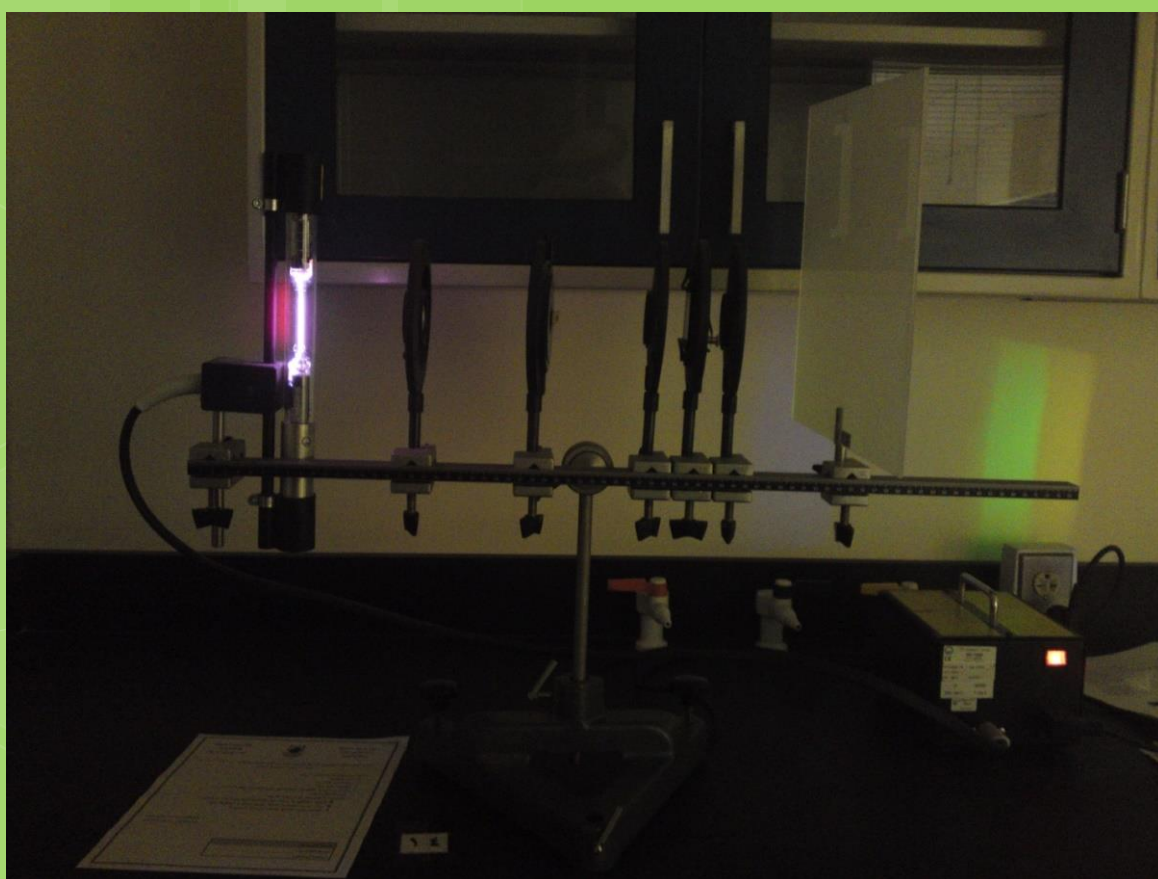


Umm Al-Qura University
Faculty of Applied Science
Physics Department



Physics Laboratories Handbook



Physics Laboratory
Committee
2017

مقدمة

الحمد لله رب العالمين والصلاة والسلام على سيدنا ونبينا محمد وعلى آله وأصحابه والتابعين إلى يوم الدين.

إن معمل الفيزياء يعتبر من أهم ما يكتسبه طالب العلوم عموماً وطالب الفيزياء خاصة في دراسته الجامعية. فالإلى جانب متعة الطالب أثناء إجراء التجارب فهو الوسيلة الوحيدة لتطبيق وممارسة ما يتم دراسته نظرياً في المحاضرات، وهذا من شأنه تثبيت المعلومات النظرية وتوسيع فهمه للمادة النظرية. هذا بالإضافة لعدة مكتسبات أخرى تفيد الطالب سواء أثناء فترة دراسته أو بعد تخرجه منها:

- ١- أن المعمل يعلم الطالب الانضباط والجدية في التعامل مع الأجهزة المختلف.
- ٢- الدقة وهي تعتبر سمة رئيسية، يجب أن يتحلى بها طالب الفيزياء.
- ٣- القدرة على التعامل مع الأجهزة بالقدر اللازم من الحرص وتقدير خطورة الموقف.
- ٤- تنمية روح العمل الجماعي وروح الفريق أثناء إجراء القياسات.
- ٥- تنمية روح التنافس الفعال المثمر.

هذا، ويمتلك قسم الفيزياء أفضل النماذج للمعامل الطلابية على مستوى عالمي راقى، من حيث البنية التحتية ومن حيث التجارب ومدى ملائمتها لدراسة علم الفيزياء التجريبي. ويشمل قسم الفيزياء ١٣ معمل طلابي تخصصي، يغطي من خلالها الدراسة العملية للتخصصات المختلفة في علم الفيزياء سواء الفيزياء البحتة أو الفيزياء التطبيقية. ويسعى القسم إلى التطوير المستمر في المعامل الطلابية حيث يحرص على اقتناء أحدث التجارب العلمية التي تعود على الطالب بالثراء والعمق المعرفي واكتساب المهارات العملية الدقيقة.

وفقنا الله وإياكم إلى ما يحبه ويرضاه،،،

لجنة المعامل

بقسم الفيزياء

Introduction:

Physics is an experimental science and the history of science reveals the fact that most of the notable discoveries in science have been made in the laboratories. Seeing experiments being performed, i.e., demonstration experiments are important for understanding the principles of science. However, performing experiments by one's own hands is far more important because it involves learning by doing.

In Physics, an experiment is an empirical procedure that arbitrates between competing models or hypotheses. Researchers also use experimentation to test existing theories or new hypotheses to support or disprove them. Experiments form the foundation of the growth and development of science.

A general scheme of scientific investigation known as the Scientific Method involves the following steps:

- 1- **Observations:** Qualitative information about a phenomenon collected by unaided senses.
- 2- **Experimentation:** Quantitative measurements (with the help of instruments) of certain physical quantities which have some bearing on the phenomenon.
- 3- **Formulation of hypothesis:** Analysis of the data to determine how various measured quantities affect the phenomenon and to establish a relationship between them, graphically or otherwise.
- 4- **Verification:** The hypothesis is verified by applying it to other allied phenomena.
- 5- **Predictions of new phenomena.**
- 6- **New experiments to test the predictions.**

7- Modification of the law if necessary

The chief aim of experimentation in science is:

- 1- Discovering the law which governs a certain phenomenon,
- 2- Verifying a given law which has been derived from a theory
- 3- Determination of physical constants
- 4- Determination of the physical properties

The above discussion shows the importance of laboratory work and that the experimentation is vital to the development of any kind of science and more so to that of Physics.

Physics Department, at Umm Al-Qura University, includes 13 laboratories for undergraduate students in different fields of pure and medical physics. Also there are four laboratories for research in different fields of physics. The laboratories include a high quality experiments and apparatus from different international companies.

*Committee of
Physics Laboratories*

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Distribution of technician and Supervisors on The different laboratories at the Physics Department

	Laboratory	Plan	Course	Code	Technician	Supervisor
1	Lab. of General Physics (1)	19	General Physics (1)	403101	Gar Allah Al-Tawily	Dr. Said Attia
		33	---	---		
		37	General Physics (1)	403101		
2	Lab. of General Physics (2)	19	General Physics (2)	403101	Mazen Bashraf	Dr. Mehrez Loulou
		33	Classical Physics	403200		
		37	General Physics (2)	403121		
3	Lab. of Electricity and Magnetism	19	Electricity and Mangetism	403121	Yousef Alasamari	Dr. Mohamed Sabry
		33	---	---		
		37	Electricity and Mangetism	403221		
4	Lab. of General Physics 3	19	Measuring Instruments	403285	Mohamed Mirah	Dr. Abdularhaman Lahehn
		33	---	---		
		37	General Physics (3)	403222		
5	Lab. of Optics	19	Optics	403231	Mazen Malkan	Dr. Abdelmaged Timoumi
		33	Optics	403232		
		37	Optics	403231		
6	Lab. of Modern Physics	19	Atomic Physics	403253	Jameel Al-Hazmi	Dr. Abdelmaged Timoumi
		33	Modern Physics	403245		
		37	Modern Physics	403250		
7	Lab. of Nuclear Physics (1)	19	Nuclear Physics (1)	403361	Jameel Al-Hazmi	Dr. Adel Madni
		33	Nuclear Physics (1)	403460		
		37	Nuclear Physics (1)	403460		

	Laboratory	Plan	Course	Code	Technician	Supervisor
8	Lab. of Electronics	19	Electronics	403423	Hussein Althebyani	Dr. Galahl Wurefully
		33	Electronics	403473		
		37	Electronics	403473		
9	Lab. of Medical Physics	19	Medical Physics	403393	Alaa Alsubaie	Dr. Husam Salah El-Deen
		33	Medical Physics	403280		
		37	Medical Phycis	403280		
10	Lab. of Medical Radiation Physics (1)	19	Medical Radiation Physics	403365	Yaser Bahashwan	Dr. Taha Alfawal
		33	Medical Radiation Physics (1)	403384		
		37	Medical Radiation Physics (1)	403385		
11	Lab. of Medical Radiation Physics (2)	19	---	---	Yaser Bahashwan	Dr. Taha Alfawal
		33	Medical Radiation Physics (2)	403385		
		37	Medical Radiation Physics (2)	403492		
12	Lab. of Radioactive Isotopes in Medicine	19	Radioactive Isotopes in Medicine	403497	Alaa Alsubaie	Dr. Ramadan Ali
		33	---	---		
		37	----	---		
13	Lab. of Radiotheraby Physics	19	Radiotheraby Physics	403490	Yaser Bahashwan	Prof. Sameer Natto
		33				
		37	Radiotheraby Physics	403386		



Jar Allah Saeed Al-Tawili

Lab Technician.

Diploma of
Minute Labs.
Tel: 544770074
Internal Tel: 3369

Laboratory of General Physics (1)

This lab serves the following courses and students:

Study Plan	(19)	(33)	(37)
Course	General Phsyics (1)	-	General Phsyics
Code	403101	-	4031101

Students involved

1. Students of Pure Physics
2. Students of Medical Physics
3. Students of Chemistry
4. Students of Biology
5. Students of Math

Practical Lessons at the Laboratory of General physics (1)

- 1 Safety and Security in the Lab
- 2 Introduction
- 3 Precise measurements
- 4 Vectors Analysis
- 5 Determination of Viscosity
- 6 Verification of Lenses Formulae
- 7 Determination of Sound velocity





Mazen Mohamed Omar Bashraf

Lab Technician.

BSc. of
Chemistry
Tel: 54525740
Internal Tel: 3372

Laboratory of General Physics (2)

This lab serves the following courses and students:

Study Plan	(19)	(33)	(37)
Course	General Phsyics (2)	Classical Physics	General Phsyics (2)
Code	403102	403200	4032102

Students involved

1. Students of Pure Physics
2. Students of Medical Physics

Practical Lessons at the Laboratory of General physics (2)

- 1 Safety and Security in the Lab
- 2 Introduction
- 3 Simple Pendulum
- 4 Torsional Pendulum
- 5 Moment of Inertia
- 6 Projectiles
- 7 Hooke's law





Yousef Ahmed Alassmari

Lab Technician.

Graduated from
Technical college
in Electronics
Tel: 555568518
Internal Tel: 3357

Laboratory of Electricity & Magnetism

This lab serves the following courses and students:

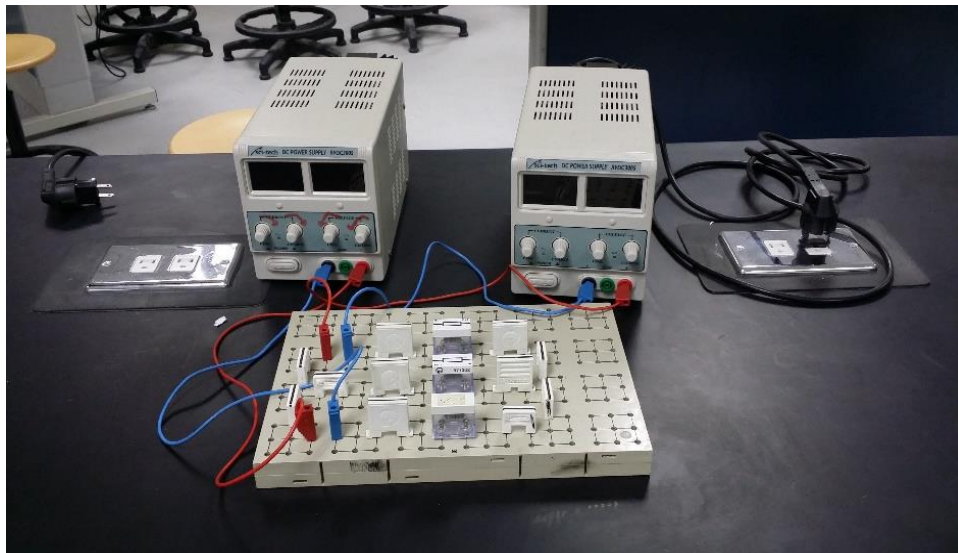
Study Plan	(19)	(33)	(37)
Course	Electricity and Magnetism	Classical Physics	Electricity and Magnetism
Code	403121	403200	4032121

Students involved

1. Students of Pure Physics
2. Students of Medical Physics

Practical Lessons at the Laboratory of Electricity & Magnetism

- 1 Safety and Security in the lab
- 2 Introduction
- 3 Verification of Ohm's Law
- 4 Determination of capacity of a capacitor
- 5 Time constant of capacitors
- 6 Kirchhoff's law





Mohamed Abdullah Omar Mirah

Lab Technician.

Diploma. of
Optics
Tel: 565559508
Internal Tel: 3366

Laboratory of Measuring Instruments

This lab serves the following courses and students:

Study Plan	(19)	(33)	(37)
Course	Measuring Instruments	-	General Physics (3)
Code	403285	-	4032122

Students involved

1. Students of Pure Physics
2. Students of Medical Physics

Practical Lessons at the Laboratory of Measuring Instruments

- 1 Safety and Security in the lab
- 2 Introduction
- 3 Solar cells characteristics
- 4 Mono beam Oscilloscope
- 5 Dual beam Oscilloscope
- 6 Electric Pulses
- 7 Low pass filter
- 8 High pass filter
- 9 Design and Calibration of Ammeter
- 10 Design and Calibration of Voltmeter





Mazen Mohsen Malkan Al-Jawi

Lab Technician.

Diploma. of
Electronics
Tel: 56663164
Internal Tel: 3399

Laboratory of Optics

This lab serves the following courses and students:

Study Plan	(19)	(33)	(37)
Course	Optics	Optics	Optics
Code	403231	403232	4042131

Students involved

1. Students of Pure Physics

Practical Lessons at the Laboratory of Optics

- 1 Safety and Security in the lab
- 2 Introduction
- 3 Interference of Light and eye resolving power
- 4 Diffraction of Light
- 5 Newton's Rings
- 6 Polarization of Light and Brewster's angle
- 7 Diffraction Grating
- 8 Study of prism properties using Spectrometers
- 9 Thermobiles
- 10 Abbe refractometer
- 11 Malus law Experiment





Jameel Ahmed Hameed Alhazmi

Lab Technician.

BSc of Physics
Tel: 555571902
Internal Tel: 3372

Laboratory of Modern Physics

This lab serves the following courses and students:

Study Plan	(19)	(33)	(37)
Course	Atomic Physics	Modern Physics	Modern Physics
Code	403253	403245	4032150

Students involved

1. Students of Pure Physics
2. Students of Medical Physics

Practical Lessons at the Laboratory of Modern Physics

- 1 Safety and Security in the lab
- 2 Introduction
- 3 Determination of e/m for electron
- 4 Determination of Planck's constant
- 5 Determination of ionization Potential
- 6 Study of Palmer series of Hydrogen lamp
- 7 Electron Diffraction: Thomson Experiment
- 8 Transmission & Absorption of X-ray
- 9 Franck Hertz experiments
- 10 Zeeman effect
- 11 Verification of Bragg law
- 12 Millikan's Experiment





Jameel Ahmed Hameed Alhazmi

Lab Technician.

BSc of Physics
Tel: 555571902
Internal Tel: 3372

Laboratory of Nuclear Physics

This lab serves the following courses and students:

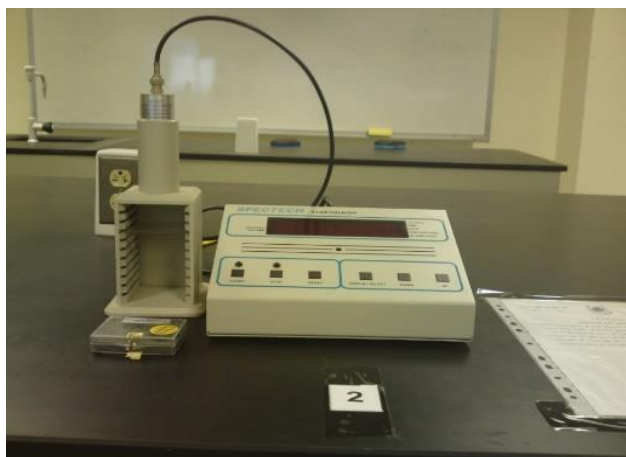
Study Plan	(19)	(33)	(37)
Course	Nuclear Physics (1)	Nuclear Physics (1)	Nuclear Physics (1)
Code	403361	403460	4034160

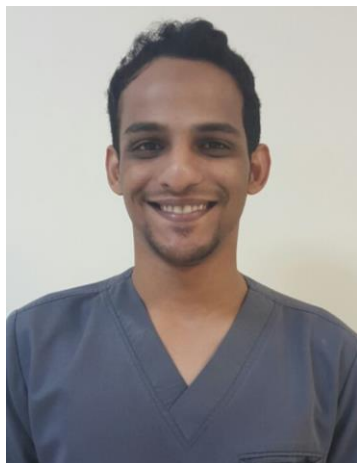
Students involved

1. Students of Pure Physics
2. Students of Medical Physics

Practical Lessons at the Laboratory of Nuclear Physics

- 1 Safety and Security in the lab
- 2 Introduction
- 3 Geiger Counter
- 4 Dead Time of the Counter
- 5 Efficiency of the Counter
- 6 Absorption of Gamma Rays
- 7 Absorption of Beta Rays
- 8 Verification of Inverse Square Law
- 9 Background Scattering
- 10 Statistics in Nuclear Physics





Hussein Hasen Althebyani

Lab Technician.

BSc of Physics
Tel: 551141492
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Laboratory of Electronics

This lab serves the following courses and students:

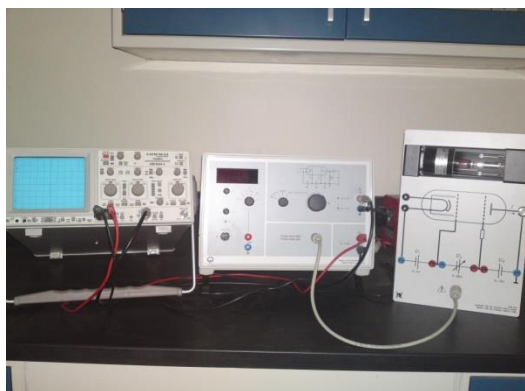
Study Plan	(19)	(33)	(37)
Course	Electronics	Electronics	Electronics
Code	403423	403473	4034173

Students involved

1. Students of Pure Physics

Practical Lessons at the Laboratory of Electronics

- 1 Safety and Security in the lab
- 2 Introduction
- 3 Characteristics of Diodes
- 4 Forward biasing of Diodes
- 5 Reverse biasing of Diodes
- 6 Light Emitting Diode (LED)
- 7 Zener Diode
- 8 Rectification by Diodes
- 9 Characteristics of bipolar Transistor
- 10 Rectifier of AC signals
- 11 Load line of Transistor
- 12 Biasing methods of Transistor





Alaa Abdularahman Alsubaie

Scientific researcher.

BSc of Physics
Tel: 549303926
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Laboratory of Medical Physics

This lab serves the following courses and students:

Study Plan	(19)	(33)	(37)
Course	Medical Physics	Medical Physics	Fundamentals of Medical Physics
Code	403393	403280	403250

Students involved

1. Students of Medical Physics

Practical Lessons at the Laboratory of Medical Physics

- 1 Safety and Security in the lab
- 2 Introduction
- 3 Radioactivity
- 4 Radioactive Dating
- 5 X-ray image quality on fluorescence screen
- 6 X-ray image quality on screen film
- 7 Detection of X-rays using ionization chamber1
- 8 Detection of X-rays using ionization chamber2
- 9 Detection of radioisotopes using ionization chamber
- 10 Human eye
- 11 Human arm 1
- 12 Human arm 2





Yaser Mohammed Bahashwan

Scientific researcher.

BSc of Physics
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Laboratory of Medical Radiation Physics (1)

This lab serves the following courses and students:

Study Plan	(19)	(33)	(37)
Course	Medical Radiation Physics	Medical Radiation Physics (1)	Medical Radiation Physics (1)
Code	403364	403384	403385

Students involved

1. Students of Medical Physics

Practical Lessons at the Laboratory of Medical Radiation Physics (1)

- 1 Safety and Security in the lab
- 2 Introduction
- 3 Determination of the Element Correction Coefficient
- 4 Determination of the Reader Calibration Factor , RCF
- 5 Assessment of the equivalent Dose
- 6 Calibration of NaI (Tl) detector for I-131 Using Thyroid Phantom
- 7 Decontamination of I-131 in working Radiation Area of Nuclear
- 8 Verification of Inverse Square Law
- 9 Measurement of Exit Dose using an applicator of 10 cm diameter
- 10 Linearity of Superficial X-ray Machine
- 11 Depth Dose Curve for kilo Voltage therapy X-ray beam
- 12 X-Ray Dose Output Reproducibility





Yaser Mohammed Bahashwan

Scientific researcher.

BSc of Physics
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Laboratory of Medical Radiation Physics (2)

This lab serves the following courses and students:

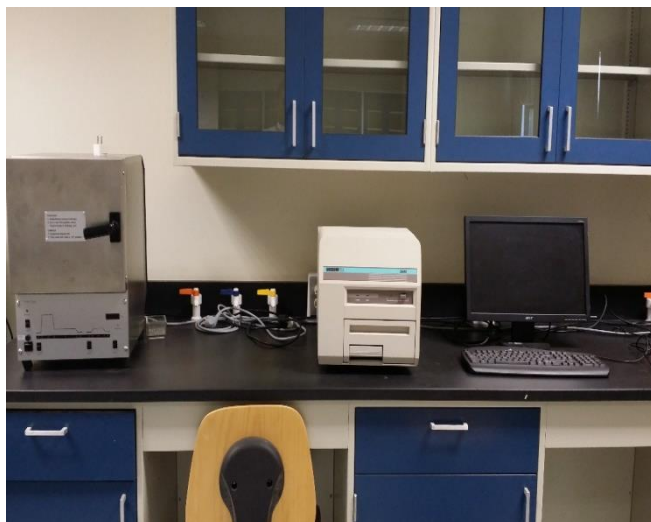
Study Plan	(19)	(33)	(37)
Course		Medical Radiation Physics (2)	Medical Radiation Physics (2)
Code		403385	403492

Students involved

1. Students of Medical Physics

Practical Lessons at the Laboratory of Medical Radiation Physics (2)

- 1 Measurements the surface Radiotherapy dose for hands
- 2 Environmental Radiation Area Survey for some selected locations
- 3 Assessment of Exit dose for patients using X-ray Sensitive Films
- 4 Radiation Area Survey Around a Co-60 units
- 5 Patient Dose Calculation using a Cal dose Computer Program





Alaa Abdularahman Alsubaie

Scientific researcher.

BSc of Physics
Tel: 549303926
Internal Tel: 3356

Laboratory of Radioactive Isotopes in Medicine

This lab serves the following courses and students:

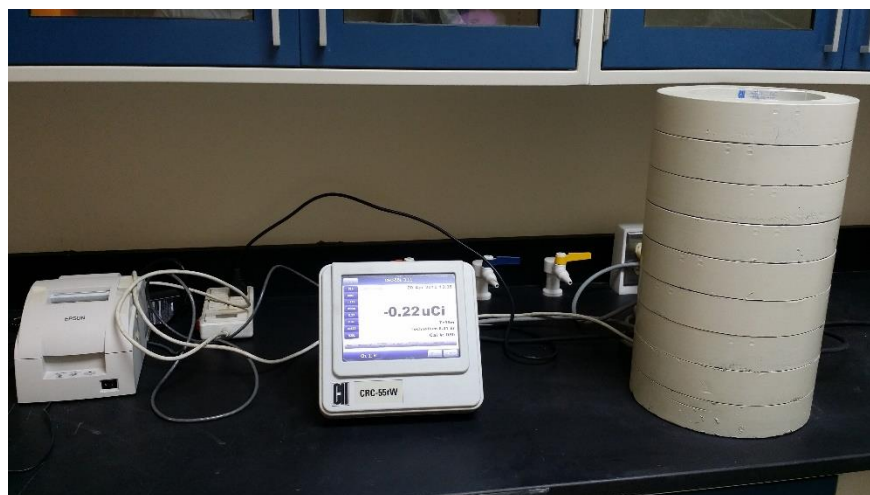
Study Plan	(19)	(33)	(37)
Course	Radioactive Isotopes in Medicine	-	Physics of Nuclear Medicine
Code	403497	-	4034295

Students involved

1. Students of Medical Physics

Practical Lessons at the Laboratory of Radioactive Isotopes in Medicine

- 1 Radioactive decay calculation (rad pro simulation)
- 2 Abilities of alpha, beta and gamma rays to pass through the air;
- 3 Determining the Effect of thickness and types of Absorber
- 4 Effect of types of Absorber
- 5 Rad lab gamma spectroscopy software
- 6 Dose Calibrator quality control (QC)
- 7 Survey Meters quality control (QC)





Yaser Mohammed Bahashwan

Scientific researcher.

BSc of Physics
Tel: 590905828
Internal Tel: 3360

Laboratory of Radiotherapy Physics

This lab serves the following courses and students:

Study Plan	(19)	(33)	(37)
Course	Radiotherapy Physics	Radiotherapy Physics	Radiotherapy Physics
Code	403490	403385	403386

Students involved

1. Students of Medical Physics

Practical Lessons at the Laboratory of Radiotherapy Physics

- 1 Introduction to the x-ray Unit and ion chamber
- 2 Machine output measurements
- 3 HVL Measurements for the x-ray tube
- 4 PDD Measurements
- 5 Back-Scatter Factor Measurements
- 6 TAR and TPR Measurements
- 7 Inverse Square Law
- 8 Measurements of Collimator Scatter Factor S_c and Phantom Scatter Factor S_p
- 9 Output of the machine at different Field Sizes
- 10 Beam profiles
- 11 Manual Dose Distribution using two parallel opposed fields
- 12 Manual Dose Distribution using four-fields



Laboratories for Scientific Research

	Laboratory	Main Facilities
1	Laboratoire of Nano-Science	X-Ray Diffraction
		Scanning Electron Microscope
		Preparation equipment: magnetic stirrer, oven, etc.
2	Laboratoire of thin film	Thermal evaporation Coating unit
		Spin coating + Dip coating units
		IR spectrometer
3	Laboratoire of Solid State	Impedance analyzer
		UV-VIS-near IR spectroscopy
		Mechanic properties measurements
4	Laboratoire of Solar Energy	Dip coater
		Tools to measure IV characteristic curve
		Other tools for preparation of the samples
5	Laboratoire of Medical Physics	X-Ray therapy Unit – Co ⁶⁰ Source
		Rehometer – TLD reader
		HIOKI high tester