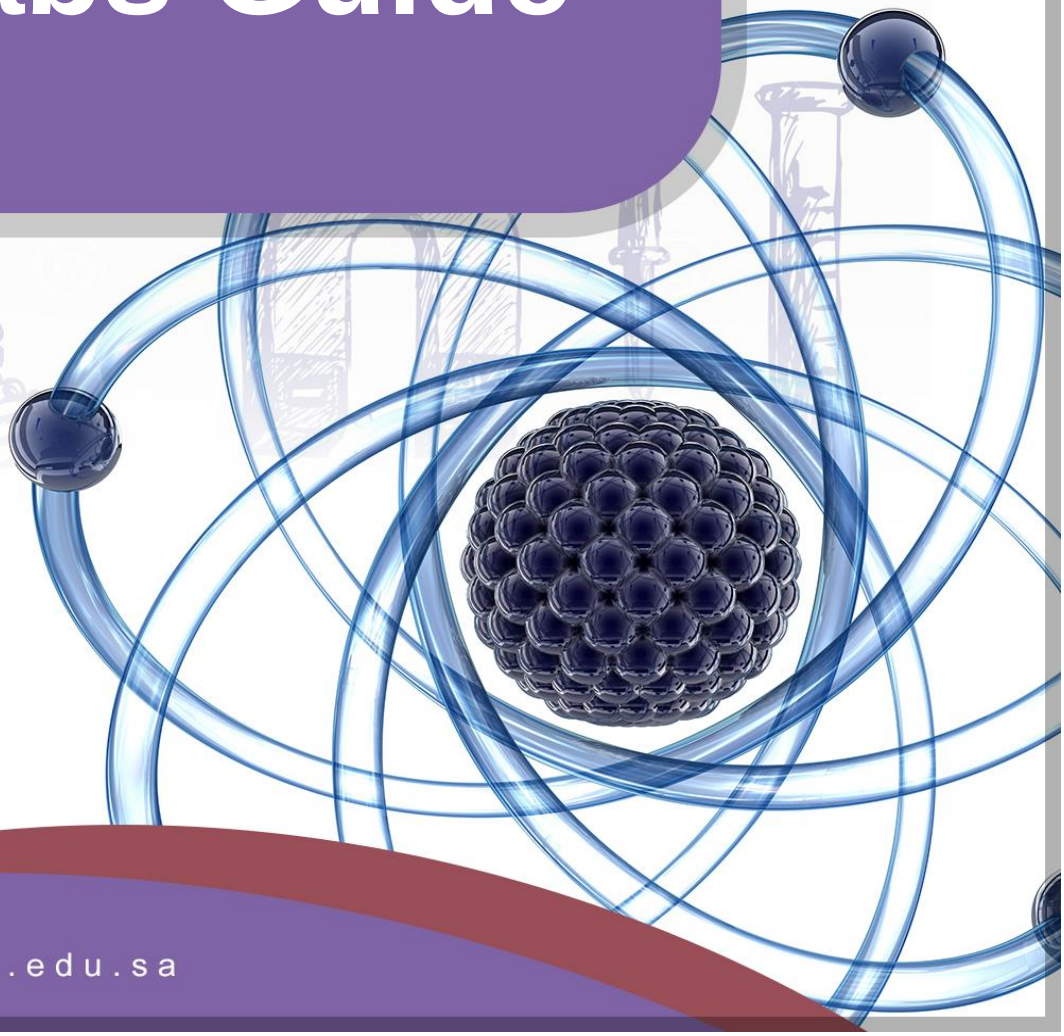
Ministry of higher education
Majmaah university
College of Science
Department of Physics

وزارة التعليم العالي
جامعة المجمعة
كلية العلوم
قسم الفيزياء

جامعة المجمعة
Majmaah University

Labs Guide



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Kingdom of Saudi Arabia
Ministry of Higher Education
Majmaah University
College of Science
Department of Physics

بسم الله الرحمن الرحيم

جامعة المجمعة
Majmaah University

المملكة العربية السعودية
وزارة التعليم العالي
جامعة المجمعة
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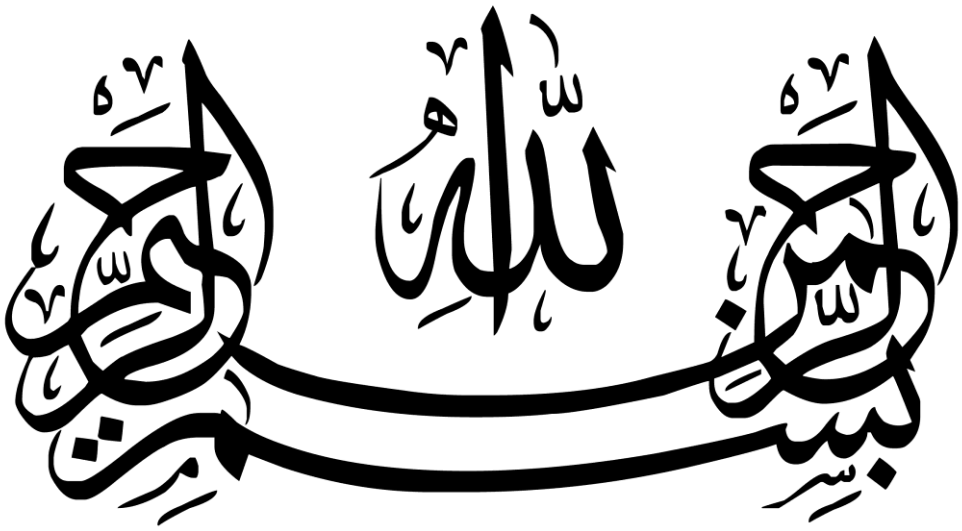
Laboratories Guide

PHYSICS
Department

College of Science Al-Zulfi

2013 -1434 H



Contents

Head of Department Message

All Praise is due to Allah, the Lord of the worlds, and blessings and peace be upon our Prophet Muhammad and his Family and Companions.

It is my pleasure and good fortune to contribute to the website of the Physics Department with these humble words and to shed some light on its Faculty of Science at Majmaah University. I thank The Almighty God for His grace and gratitude that has placed me here to serve the religion, the nation, society in general and the university and this college in particular. My thanks go to their Excellences the Rector and the vice deans of the University, the Dean of the College of Science in Zulfi and my colleagues for the facilities and guidance they have provided in order to serve the university. They have ensured the development and upgrading of their department to its best levels.

Physics is the science that studies everything related to material, its movement and energy; it tries to understand natural phenomena and the forces affecting the functioning of material and formulates knowledge of the laws that do not only explain the processes above, but also the prediction of the natural processes with models that slowly and gradually approach reality.

Physics is at the same also interested in accurately measuring and inventing new ways of increasing a basis of reaching a proper interpretation of natural phenomena. Physics provides the art of measurement methods for use in all the vital and natural sciences like Chemistry, Medicine, Engineering, Biology and other sciences. The progress of civilization is due to the impressive progress of the science of physics. All the devices that we use in our daily lives are based on physics, such as radar, wireless, radio, color TV, phones, laptop computers, cell phones and diagnostic devices in medicine, such as X-rays, magnetic resonance imaging, radiotherapy, glasses, telescopes and space probes, microwave ovens, power transistors, the microphone and electricity.

Head of the Physics Department

Dr. Thamir Shelih Al.Harbi

Vision, Mission and Objectives:

Vision:

Producing a promising and qualified national generation with high efficiency and experience in the field of physics to meet the needs and requirements of the labor market.

Mission:

The physics laboratories unit seeks to develop the practical side in the educational process and research by improving the capabilities and expertise to interact with current and future needs of the University and the surrounding community.

Objectives:

1. Provide a disciplined learning environment for the students.
2. Improve the efficiency of the graduates in the field of physics to work at all levels.
3. Deepen students' understanding of the different physical phenomena.
4. Prepare the students to be able to pursue higher studies in the field of physics.

Labs Committee:

Formation:

A sub-committee is formed annually by the board of the physics department called Labs Committee. This committee chaired by the head of the department and the membership of all faculty staff members who teach in any of the department labs, as well as the membership of laboratory technicians in the department.

Tasks:

- The committee is responsible for a general supervision of all department laboratories and stands on all their needs and deficiencies providing periodically the board of the physics department with records of their meetings.
- The Committee draws public policies in the laboratory and prepares their own reports.
- The Committee of the department laboratories evaluates their safety standards and recommend what is necessary to the board of the physics department.

Physics Labs:

Physics deparment has the following labs:

1- General Physics Lab Phys. 101
2- General Physics Lab Phys. 202
3- Thermal Physics Lab
4- Electromagnetism Lab
5- Optics Lab
6- Electronics Physics Lab
7- Modern Physics Lab
8- Solid State Physics Lab
9- Nuclear Physics Lab

These laboratories represent a basis for bachelor's degree students.

Image shows the corridor devoted to the laboratories of physics department at the university building

General Physics Lab Phys. 101

This lab aims to:
Teach students the basic laws of physics such as motion and gravity, and others.
Students take this lab in conjunction with theoretical general physics course offered at the first level to be able to understand the theories and basic laws.

Lab Experiments:

1- Free Fall
2- Simple pendulum
3- Hook's law
4- Projectile's motion
5- Vectors table
6- Inclined plane
7- Air track
8- Rotational motion

Inside the lab, there is the first aid box and also the security and safety rules.
There are a technician's room and a store room in the lab.
Inside the lab, there is a smart board with a data show.
Lab's area is 8*12 m^2.

List of Experiments of General Physics Lab (Phys. 101):

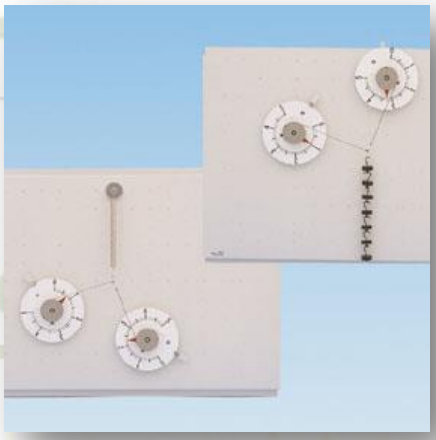
Device name:	Free Fall
Device Lab.:	General Physics I
Device Aim: To determine the amount of acceleration due to gravity.	
Device Operation: Attach the steel ball to the magnet. Adjust the height of the ball to a certain value. Measure the distance between the ball and the light barrier. Press the "start" button on the digital counter. The ball will fall spontaneously. Once the ball reaches the light barrier the counter will stop spontaneously. Record the time of the trip.	

Device name:	Simple Pendulum
Device Lab.:	General Physics I
Device Aim: Determine the gravitational acceleration.	
Device Operation: Mount the metallic ball using a string. Measure the length of the string. Raise the ball to a certain height, then let the ball oscillates on its own. Measure the time needed for certain number of complete oscillations. Calculate the gravitational acceleration.	

Device name:	Hook's Law
Device Lab.:	General Physics I
Device Aim: Determining the spring constant of a helical spring..	
Device Operation Hang the spring on the stand rod. Attach weights to the spring. Measure the amount of expansion of the spring after each load.	

Device name:	Projectile Motion
Device Lab.:	General Physics I
Device Aim: To record the projection parabola as a function of the speed and angle of projection.	
Device Operation: - Set the experiment as shown in the graph. - Adjust the angle of projection to a certain value. - Adjust the speed of projection. - Place the steel ball in the projection apparatus. - Eject the ball and find the horizontal and vertical distance.	

Device name:	Vectors Table
Device Lab.:	General Physics I
Device Aim: To understand the composition and resolution of vectors.	
Device Operation: Hang the necessary weights on each of the three sides of the vector table till the ring is centered in the middle of the table. Read and record the values of the angles at which the strings are located. Draw the vector analysis diagram	



Device name:	Inclined Plane
Device Lab.:	General Physics I
Device Aim: To determine the coefficient of static friction. To determine the forces normal and along the plane..	
Device Operation: Place the trolley on the top of the inclined plane. Attach two dynamometers to the trolley, parallel and normal to the trolley. Free the trolley and record your results.	

Device name:	Air Track
Device Lab.:	General Physics I
Device Aim: To record the path-time diagrams of linear motion using light barrier.	
Device Operation: - Set up the apparatus as illustrated in the figure. - Turn on the vacuum machine, and let the trolley move on its own. - Measure the distance between the two light barriers. The light barriers will measure the time of interval.	

Device name:	Rotational Motion
Device Lab.:	General Physics I
Device Aim: To record the path-time diagrams of rotational motions using light barrier.	
Device Operation: - Set up the apparatus as illustrated in the figure. - Release the weights attached to the string. The plexiglass desk will start rotating. The light barrier will measure the obscuration time which enables the calculation of the instantaneous angular momentum.	

Device name:	Air Track
Device Lab.:	General Physics I
Device Aim: To study the relation between energy and momentum in elastic and an inelastic collisions using forked light barriers	
Device Operation: Position the trolleys and forked light barriers on the air track as shown in the figure. Measure the mass of each trolly. Release the trollies and measure their velocities using the light barriers. For inelastic collisions, attach a rubbery material on the front of one of the trolleys and follow the same steps.	

General Physics Lab Phys. 202

This lab aims to:
Teach students the basic laws of electricity.
Students take this lab in conjunction with theoretical general physics course Phys. 202 offered at the third level to be able to understand the theories and basic laws.

Lab Experiments:

1. Verification of levitation law
2. Verification of Ohm's law
3. Parallel plate capacitor
4. Charging and discharging of capacitors
5. LC circuits
6. Mirrors and lenses
7. Velocity of sound
8. Refractive index of glass prism

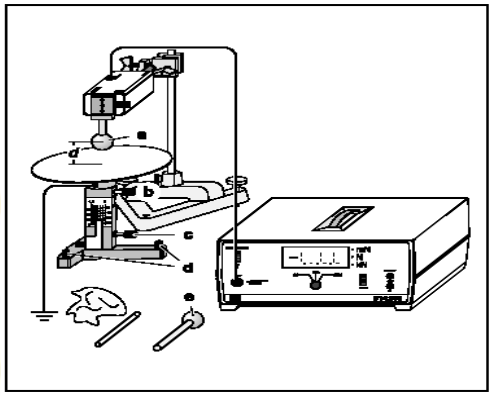
Inside the lab, there is the first aid box and also the security and safety rules.
There are a technician's room and a store room in the lab.
Inside the lab, there is a smart board with a data show
Lab's area is 8*6 m^2.

List of Experiments of General Physics Lab (Phys. 202):

Experiment: 1	Verification of Coulombs Law
Device Lab.:	General Physics II

Objects of the experiments:

Measuring the force F between two charged spheres as a function of the distance d between the center of the spheres.
Verifying Coulombs law.

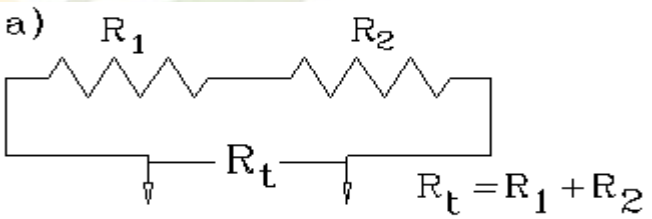


Experiment 2	VERIFICATION OF OHM'S LAW
Device Lab.:	General Physics II

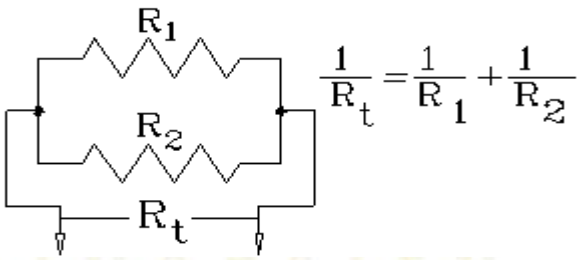
Goals:

1. To verify Ohm's law.
2. To determine the value of an unknown resistance.
3. To verify the law of parallel combination of resistors.
4. To verify the law of series combination of resistors.

a)



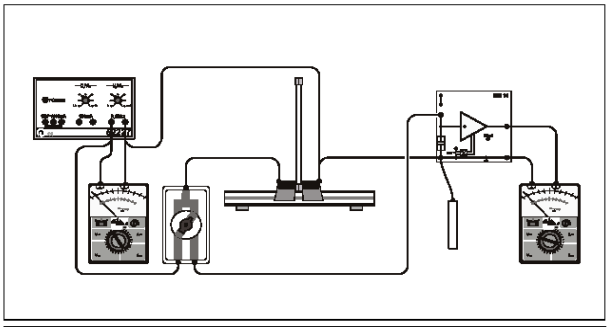
b)



Experiment 3	Parallel-Plate Capacitor
Device Lab.:	General Physics II

Objects of the experiment:

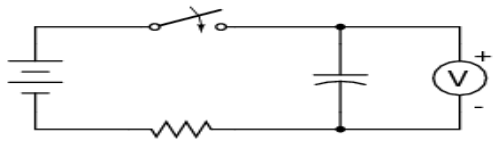
1- Determination of capacitance of a plate capacitor.
2- Determination of the dielectric constant of non-conducting material (Polystyrene or glass).
3- Determination of the capacitance of a plate capacitor as a function of the distance d, between the plates.



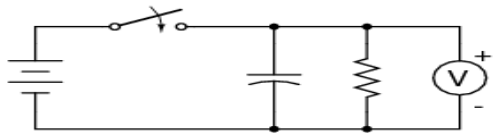
Experiment 4:	Charge and discharge of a capacitor
Device Lab.:	General Physics II

Objects:

(1) Measuring the charging and discharging curve of a capacitor.
(2) Determining the time constant.
(3) Determining the capacitance of the capacitor.



Charging circuit

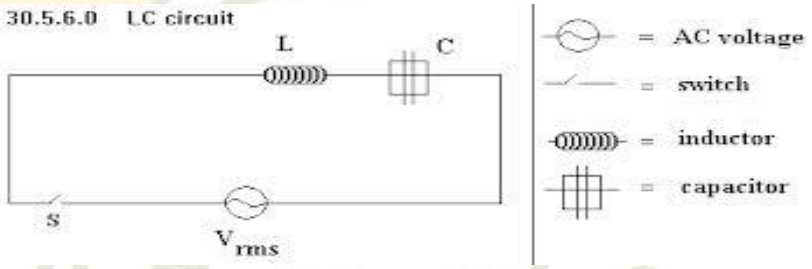


Discharging circuit

Experiment 5:	LC Circuit
Device Lab.:	General Physics II

Goals:

1. To determine the resonance frequency f_o by recording the resonance curve.
2. To measure the band width and quality factor Q.
3. To determine the inductance value L of a coil.

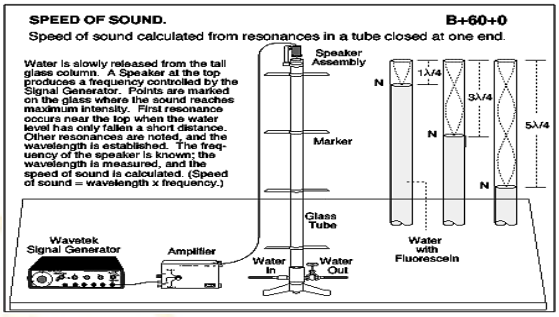


Experiment 6:	Lenses and Mirrors
Device Lab.:	General Physics II

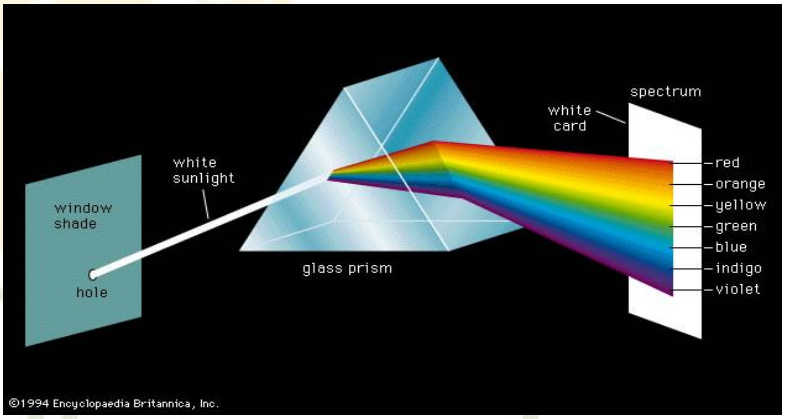
Objects :

1- Determination of the focal length and power of a convex lens by the far object method.
2- Determination of the focal length and power of a convex lens by the general method.
3- Determination of the focal length and power of a convex and convex mirrors by the coincidence of the image and object.

Experiment 7:	Speed of sound
Device Lab.:	General Physics II
Goals : 1-Calculating the speed of sound in air and the end correction of the tube. 2- Calculating the speed of sound in solid tubes.	



Experiment 8:	Refractive index and dispersion of a prism
Device Lab.:	General Physics II
Goals: 1-To study the dispersion of glass prisms and water. 2-To determine the refractive index n of glass and water. 3- To determine the dependence of refractive index on the wavelength.	



Thermal Physics Lab:

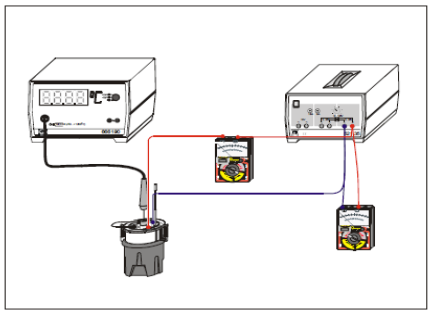
This lab aims to:
help the students to know the experiments and basics of thermal physics and its applications.

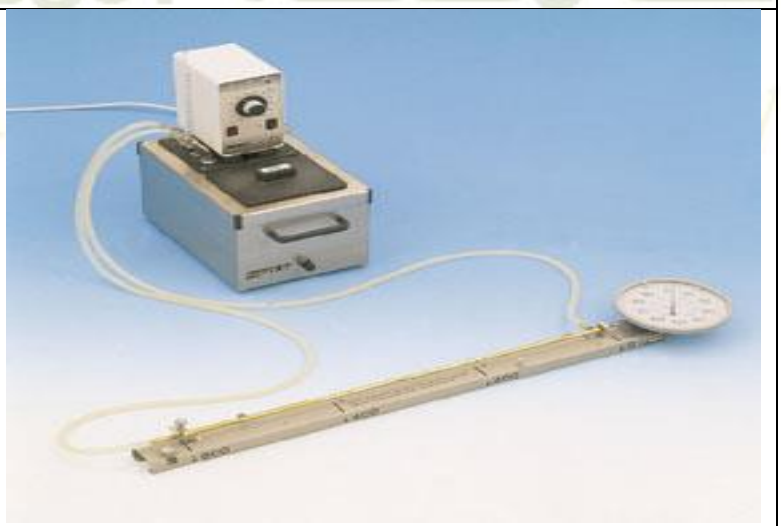
Lab Experiments:

1. Determining the specific heat of solids.
2. Converting electrical into heat energy – measuring with the voltmeter and ammeter.
3. Converting electrical energy into heat energy – measuring with the joule and wattmeter.
4. Pressure-dependency of the volume of a gas at a constant temperature (Boyle-Mariotte's law).
5. Measuring the linear expansion of solids as a function of temperature.
6. Determining the adiabatic exponent c_p/c_V of air after Rüchardt.

Inside the lab, there is the first aid box and also the security and safety rules.
There are a technician's room and a store room in the lab.
Inside the lab, there is a smart board with a data show.
Lab's area is 8*6 m^2.

List of Experiments of Thermal Physics Lab:

<table>
<tr><td>Experiment 1:</td><td>Determining the specific heat of solids</td><td rowspan="2">  </td></tr>
<tr><td>Device Lab:</td><td>Thermal Physics Lab</td></tr>
<tr><td colspan="2">Objects of the experiment:
Mixing cold water with heated copper, lead or glass shot and measuring the mixture temperature.
Determining the specific heat of copper, lead and glass.</td></tr>
<tr><td>Experiment 2:</td><td>Converting electrical into heat energy – measuring with the voltmeter and ammeter</td><td rowspan="3">  </td></tr>
<tr><td>Device Lab:</td><td>Thermal Physics Lab</td></tr>
<tr><td colspan="2">Objects of the experiment:
The aim of the experiment is to establish the equivalence of electrical and heat energy.</td></tr>
<tr><td>Experiment 3:</td><td>Converting electrical energy into heat energy – measuring with the joule and wattmeter.</td><td rowspan="2">  </td></tr>
<tr><td>Device Lab:</td><td>Thermal Physics Lab</td></tr>
</table>

<table>
<tr><td colspan="2">Objects of the experiment:
Determination of the electrical energy and thermal energy.
Confirming the equivalence of the energy quantities 1 Ws and 1 J.</td><td></td></tr>
<tr><td>Experiment 4:</td><td>Pressure-dependency of the volume of a gas at a constant temperature (Boyle-Mariotte’s law).</td><td rowspan="3">  </td></tr>
<tr><td>Device Lab:</td><td>Thermal Physics Lab</td></tr>
<tr><td colspan="2">Objects of the experiment:
Measuring the volume V of an air column as a function of the pressure p at a constant temperature T.
Confirming Boyle-Mariotte’s law.</td></tr>
<tr><td>Experiment 5:</td><td>Measuring the linear expansion of solids as a function of temperature.</td><td rowspan="3">  </td></tr>
<tr><td>Device Lab:</td><td>Thermal Physics Lab</td></tr>
<tr><td colspan="2">Objects of the experiment:
Measuring the linear thermal expansion of brass, steel and glass tubes as a function of temperature.
Determining the linear expansion coefficients of brass, steel and glass.</td></tr>
</table>

Experiment 6:	Determining the adiabatic exponent c_p/c_V of air after Rüchardt.	
Device Lab:	Thermal Physics Lab	
Objects of the experiment: • Measuring of the oscillation period of a steel ball. • Determining the adiabatic coefficient of air.		

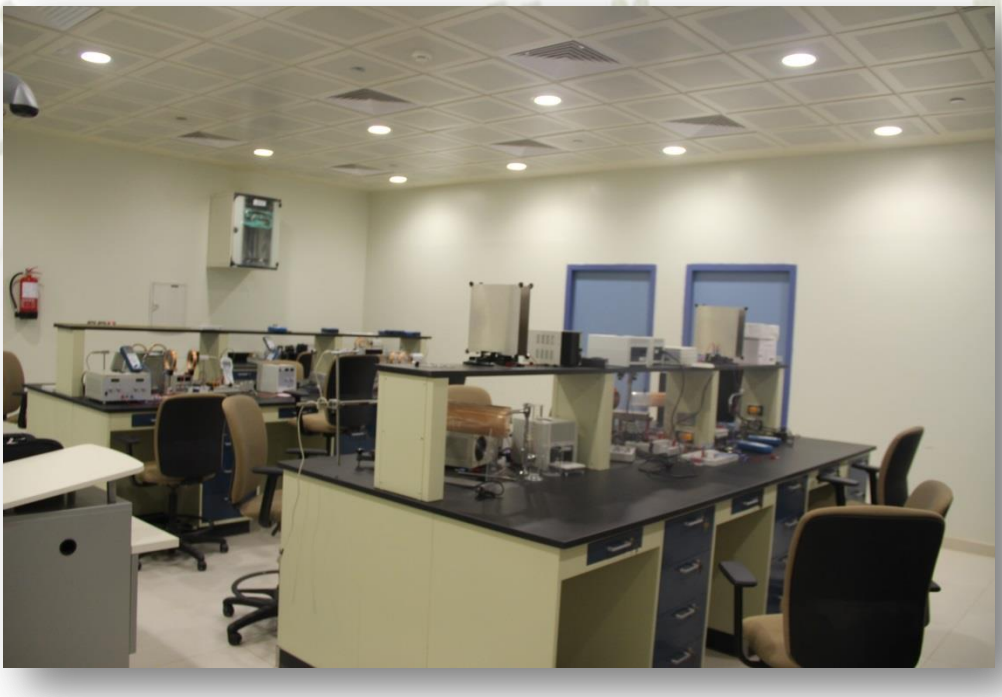
Electromagnetism lab

This lab aims to:
give the student the skills in the practical application of the laws and theories of electromagnetism that have been studied in the theoretical part.
Students take this lab in conjunction with theoretical electromagnetism course offered at the fourth level to be able to understand the theories and basic laws.

Lab Experiments:

1. Verification of electron deflection in electric and magnetic fields.
2. Measurement of the effective force on a conductor in a horseshoe magnetic field.
3. Measuring the induction voltage in a conductor loop for a variable magnetic field.
4. Measuring the magnetic field for a straight conductor and for circular loops.
5. Measuring the magnetic field of an air coil.
6. Voltage and current with transformer
7. Voltage transformation with transformer under load.

Inside the lab, there is the first aid box and also the security and safety rules.
There are a technician's room and a store room in the lab.
Inside the lab, there is a smart board with a data show
Lab's area is 8*6 m^2.



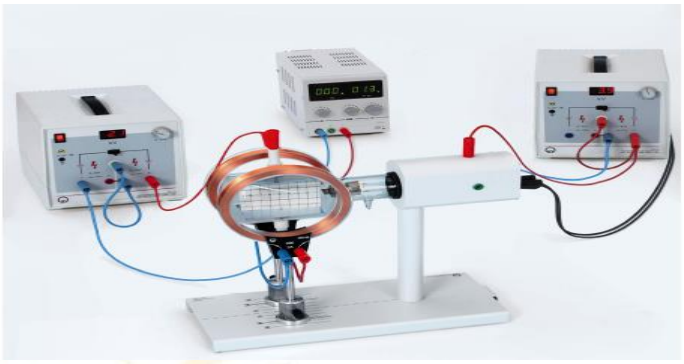
List of Experiments of Electromagnetism Lab:

Experiment 1:	Investigating the deflection of electrons in electrical and magnetic fields
Device Lab.:	Electromagnetism lab

Objects of the experiment

Investigation of the deflection of electrons in the electrical field of a plate capacitor

Investigation of the deflection of electrons in the magnetic field of a Helmholtz pair of coils



Experiment 2:	Measuring the force acting on current-carrying conductors in the field of a horseshoe magnet
Device Lab.:	Electromagnetism lab

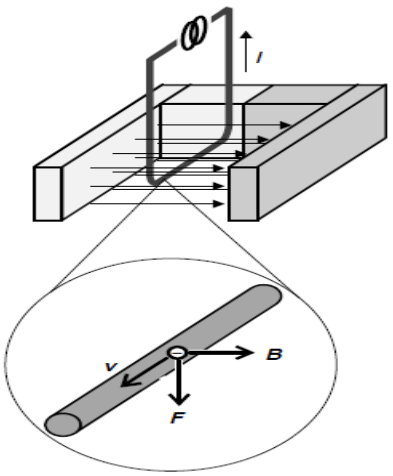
Objects of the experiment

1- Measuring the force acting on a current-carrying conductor in the magnetic field as a function of the current intensity.

2-Measuring the force acting on a current-carrying conductor in the magnetic field as a function of the conductor length.

3-Measuring the force acting on a current-carrying conductor in the magnetic field as a function of the angle between the magnetic field and the direction of the current.

Calculating the magnetic field.- 4



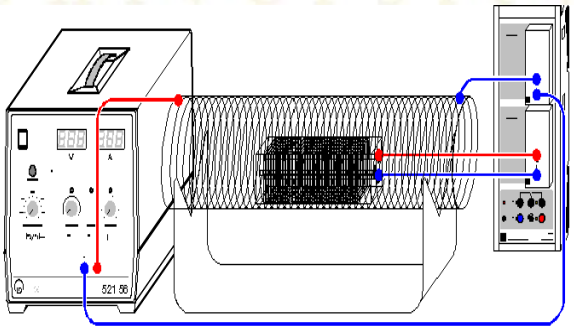
Experiment 3:	Measuring the induction voltage of a conductor loop in a variable magnetic field
Device Lab.:	Electromagnetism lab

Objects of the experiment

To measure the induction voltage as a function of the speed of the conductor loop.

To measure the induction voltage as a function of the width of the conductor loop.

To measure the induction voltage as a function of the magnetic flux density.



Experiment 4:	Measuring the magnetic field for a straight conductor and on circular conductor loops
Device Lab.:	Electromagnetism lab

Objects of the experiments
Measuring the magnetic field of a straight conductor and of circular conductor loops as a function of the current.
Measuring the magnetic field of a straight conductor as a function of the distance from the axis of the conductor.
Measuring the magnetic field of circular conductor loops as a function of the loop radius and the distance from the loop

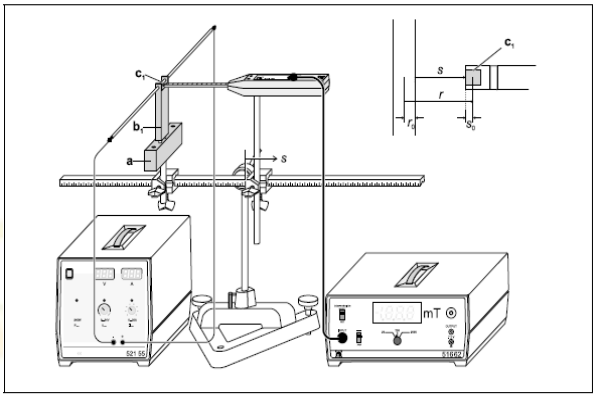
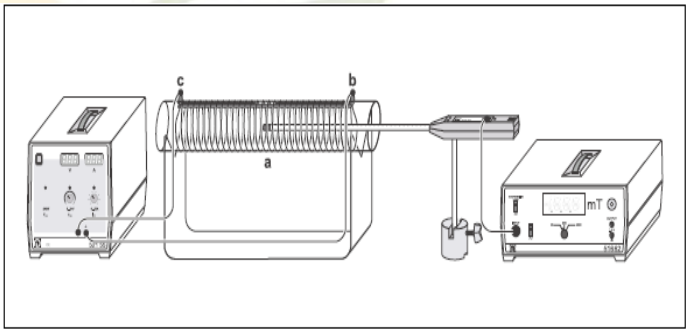


Fig. 4 Experimental setup for measuring the magnetic field at a straight conductor

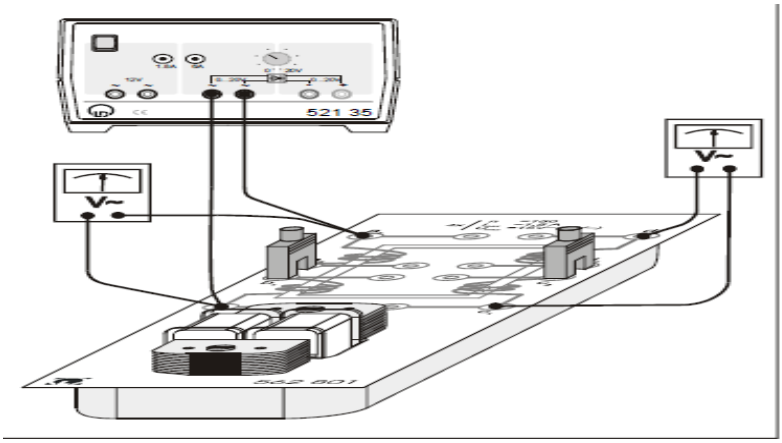
Experiment 5:	Measuring the magnetic field of an air coil
Device Lab.:	Electromagnetism lab

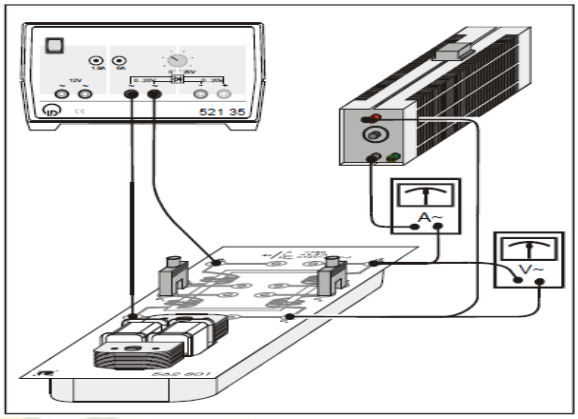
Objects of the experiments:
Measuring the magnetic field B of a long air coil as a function of the current I.
Measuring the magnetic field B of a long air coil as a function of the length L and the number N of turns of the coil



Experiment 6:	Voltage and current transformation with a transformer
Device Lab.:	Electromagnetism lab

Objects of the experiment
Measuring the secondary voltage of an unloaded transformer as function of the primary voltage for several ratios of windings between primary and secondary coil.
Measuring the secondary current of a transformer in short-circuit operation as function of the primary current for several ratios of windings between primary and secondary coil.
Demonstration of an isolating transformer and an autotransformer.



Experiment 7:	Voltage transformation with a transformer under load	
Device Lab.:	Electromagnetism lab	
Objects of the experiment Measuring the secondary voltage and current of a 'soft' and a 'hard' transformer as function of the load Determination of the output power of a transformer under load as function of the current in the secondary coil. Investigation of the lines of the magnetic flux in a 'soft' and a 'hard' transformer		

Optics lab:

This lab aims to:
give the student the practical skill to know the wave phenomena (interference and diffraction and polarization) in a practical way with the training to deal with the source of X-Ray Laser.

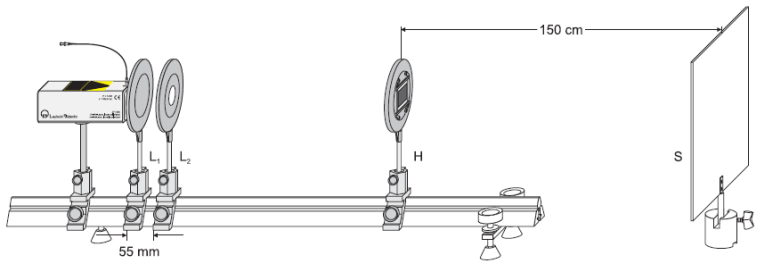
Lab Experiments:

1. Single-slit diffraction.
2. Double-slit diffraction.
3. One and two dimensional diffraction grating.
4. Interference at a Fresnel's mirror with He-Ne Laser.
5. Lloyd's mirror experiment with He-Ne Laser.
6. Newton's rings in reflected monochromatic light.
7. Michelson interferometer experiment.
8. Measurement of He-Ne Laser wavelength by using Michelson interferometer.
9. Reflection and Polarization.
10. Quarter Wave plate and Half Wave plate.

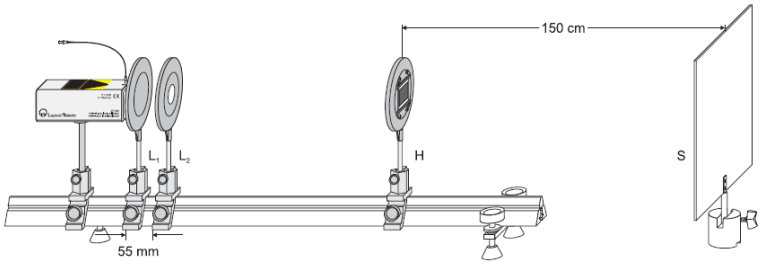
Inside the lab, there is the first aid box and also the security and safety rules.
There are a technician's room and a store room in the lab.
Inside the lab, there is a smart board with a data show.
Lab's area is 8*6 m^2.

List of Experiments of Optics Lab:

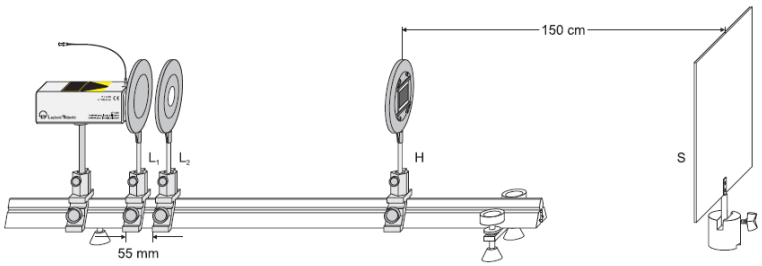
Experiment 1:	Diffraction at a slit, at a post and at a circular iris diaphragm
Device Lab.:	Optics lab
Objects of the experiments Investigating diffraction at a slit at different slit widths and determining the slit width. Investigating diffraction at a post and confirming Babinet's principle. Investigating diffraction at a circular iris diaphragm at different hole diameters and determining the diameter of a hole.	



Experiment 2:	Diffraction at a double slit and at multiple slits
Device Lab.:	Optics lab
Objects of the experiments: Investigating diffraction at a double slit for various slit spacings. Investigating diffraction at a double slit for various slit widths. Investigating diffraction at multiple slits for various slit numbers	

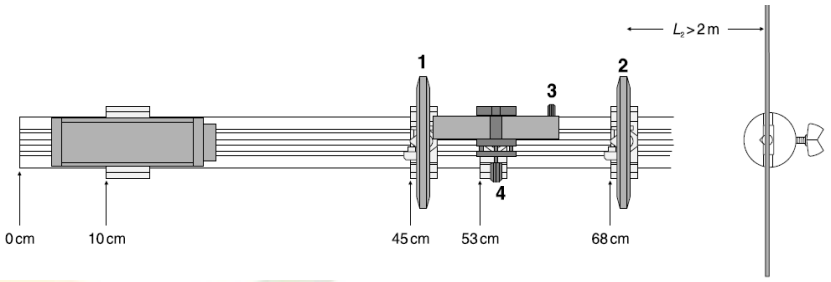


Experiment 3:	Diffraction at one- and two dimensional Gratings
Device Lab.:	Optics lab
Objects of the experiment: Investigating the diffraction phenomena at groove gratings and crossed gratings. Determining the wavelength. Determining the grating constant.	



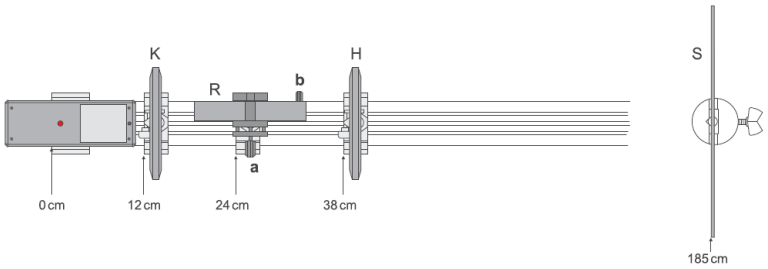
Experiment 4:	Interference at a Fresnel's mirror with an He-Ne laser
Device Lab.:	Optics lab

Objects of the experiment
To generate two virtual, coherent light sources through reflection of a point-shaped light source at a Fresnel's mirror.
To observe the interference of the two virtual light sources.
To measure the distance d of the interference lines.
To generate projected images of the virtual light sources.
To measure the distance A of the projected images.
To determine the wavelength l of the light of an He-Ne laser from the distance d of the interference lines, the distance A of the projected images of the virtual light sources and the geometrical dimensions of the assembly.



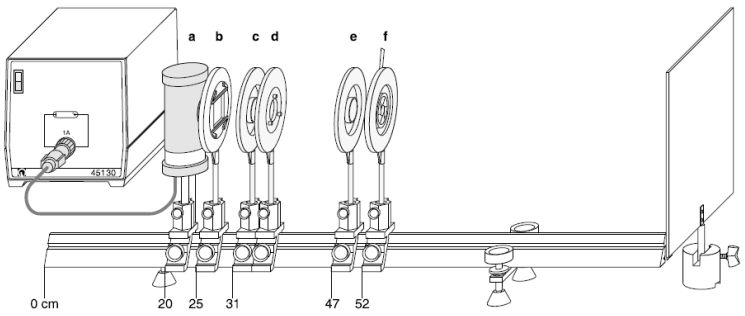
Experiment 5:	Lloyd's mirror experiment with an He-Ne-Laser
Device Lab.:	Optics lab

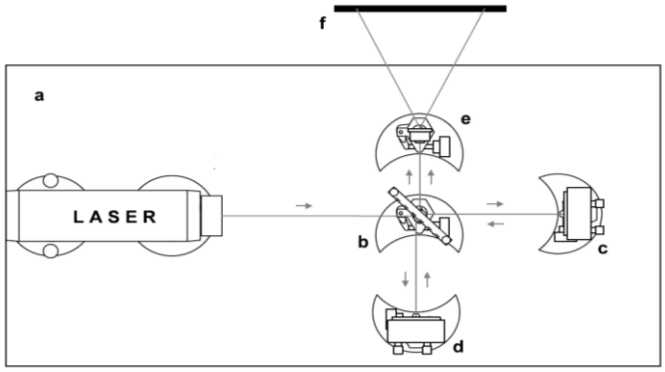
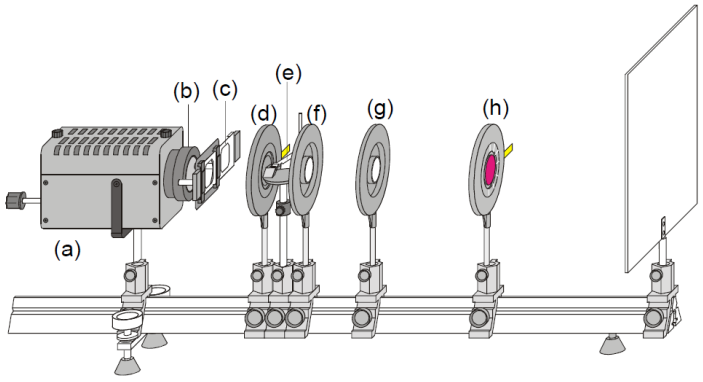
Objects of the experiments
Observing the two-beam interference of the direct and the reflected beam
Determining the wavelength of the laser



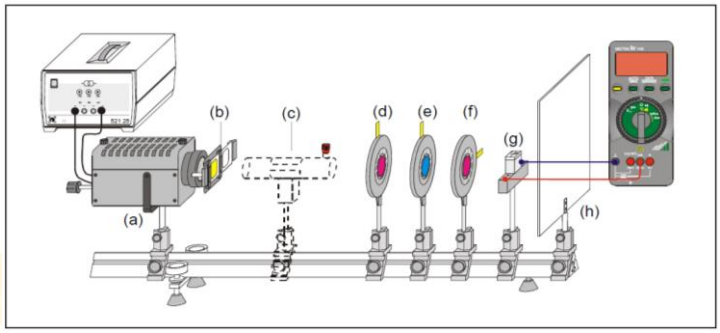
Experiment 6	Newton's Rings in Transmitted Monochromatic Light
Device Lab:	Optics lab

Objects of the experiment
To demonstrate Newton's rings in transmitted light as a system of interference rings between a flat glass plate and a planoconvex lens.
To determine the bending radius of the planoconvex lens by measuring the Newton's rings when illuminating with the yellow light of the sodium spectrum.
To investigate the dependency of the Newton's rings on the wavelength of the light by illuminating with monochromatic light from the mercury spectrum.



Experiment 7:	Setting up a Michelson interferometer on the laser optics base plate	
Device Lab.:	Optics lab	
Objects of the experiment Assembling a Michelson interferometer Observing the interference pattern		
Experiment 8:	Determining the wavelength of the light of an He-Ne laser using a Michelson interferometer	
Device Lab.:	Optics lab	
Objects of the experiment Assembling a Michelson interferometer To observe the interference pattern		
Experiment 9:	Birefringence and polarization with calcite (Iceland spar)	
Device Lab.:	Optics lab	
Objects of the experiment Observing the splitting of a light bundle when passing through a spar crystal. Verification that the two light bundles are polarized perpendicularly to each other		

Experiment 10:	Quarter-wavelength and half-wavelength plate
Device Lab.:	Optics lab
Objects of the experiment Measuring the light intensity as function of the analyzer position. Using the quarter wave plate to produce circularly polarized light.	



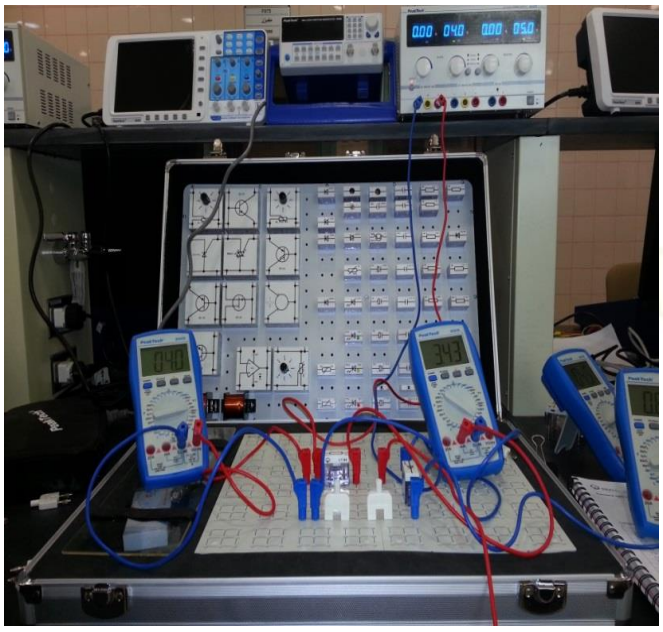
Electronics Physics Lab:

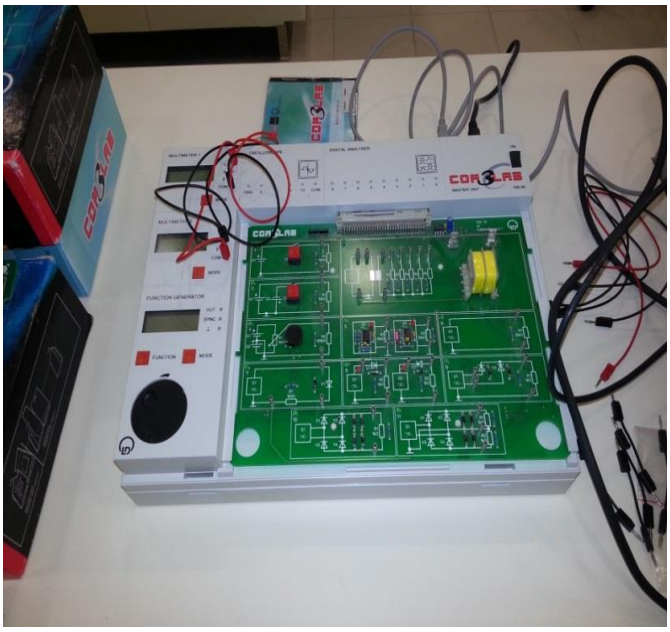
This lab aims to:
The objective of this lab is to give students skills in the analysis and the installation of an electronic circuit core, whether analogue or digital, and identify the function of electronic circuits that are exposed and comparison circuits analogue and digital through the ease and accuracy and demonstrate skills in conducting laboratory experiments through the use of modern equipment and software design.

Lab Experiments:

1- LOGIC GATES.
2- Equality.
3- Simplification.
4- Examples with many input variables.
5- MEMORY ELEMENTS AND FLIP-FLOPS.
6- 555 Timer and Digital Clock.

Inside the lab, there is the first aid box and also the security and safety rules.
There are a technician's room and a store room in the lab.
Inside the lab, there is a smart board with a data show.
Lab's area is 8*6 m^2.

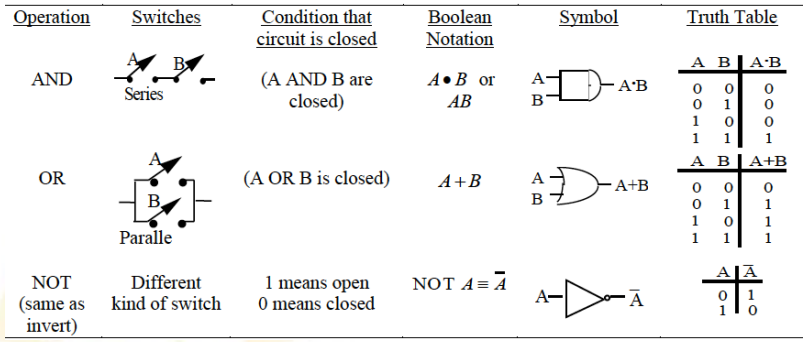




List of experiments of Electronics Physics Lab:

Experiment1	LOGIC GATES
Device Lab.:	electronics

The three fundamental gates AND, OR, and NOT, are named after the three fundamental operations of logic that they carry out. The AND and OR gates each have two inputs and one output. The output state is determined by the states of the two inputs.



Experiment2	Equality
Device Lab.:	electronics

Two Boolean expressions are equal if and only if their truth tables are identical.
Associative Laws
(A+B)+C = A+(B+C)
(AB)C=A(BC)
Distribution Laws
A(B+C) = AB+AB
(A+AB) = A)
(A+ Ā B) = A+B
(A+B).□ (A+C) = (A+BC)

A	B	AB	$\overline{AB}$
0	0	0	1
0	1	0	1
1	0	0	1
1	1	1	0

A	B	$\overline{A}$	$\overline{B}$	$\overline{A}+\overline{B}$
0	0	1	1	1
0	1	1	0	1
1	0	0	1	1
1	1	0	0	0

Experiment3	Simplification
Device Lab.:	electronics

Boolean algebra can be used to simplify logical expressions and reduce the number of gates required in a circuit. In Fig. 9.3 we show two ways to implement the expression, Y = A + Ā BC.

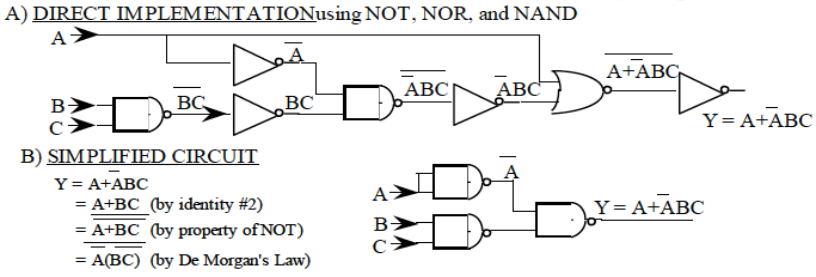


Fig. 9.3. Boolean simplification

Experiment4	Examples with many input variables
Device Lab	electronics

Here are two examples that illustrate the use of the double complement i.e., with DeMorgan's theorems for reducing expressions to a form that can be implemented with 2-input NAND and NOR, thus reducing the types of gates needed

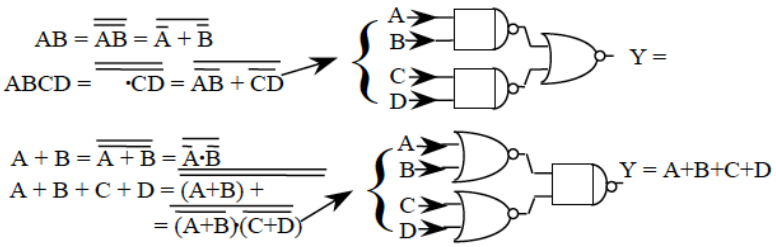


Fig. 9.4. Reduction to NAND and NOR via DeMorgan's Theorem

Experiment5	MEMORY ELEMENTS AND FLIP-FLOPS
Device Lab	electronics

In sequential logic circuits the output depends upon previous values of the input signals as well as their present-time values. Such circuits necessarily include memory elements that store the logic values of the earlier signals

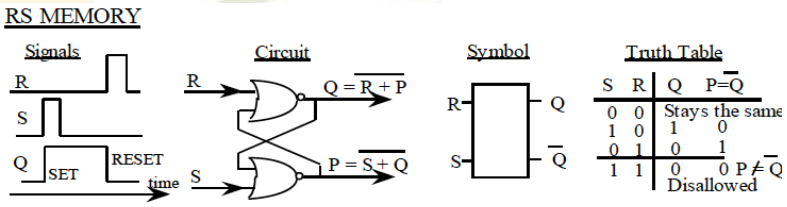
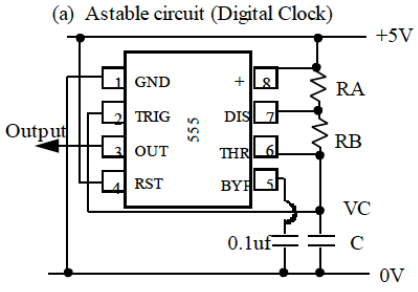


Fig. 9.5. RS memory element.

Experiment6	555 Timer and Digital Clock
Device Lab	Electronics

See FC section 11.14 for a description of the guts of the 555 timer chip. Figure 9.7 shows the circuit for generating a clock with the 555 and summarizes the formulas relating the resistor and capacitor values to the output low time T1 and the output high time T2



(b) Component values
Output High (charge time):
T2 = (RA+RB)C ln2
Output Low (discharge):
T1 = RBC ln2
Period: T = T1 + T2

(c) Limiting Values
Max RA, RB 3.3 MΩ
Min RA, RB 1 kΩ
Min. C 500pf

Modern Physics Lab:

This lab aims to:
help the students to know the experiments and basics of modern physics and its applications.

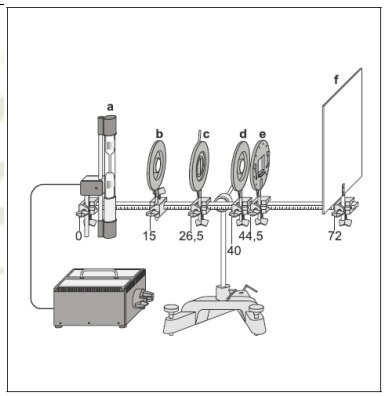
Lab Experiments:

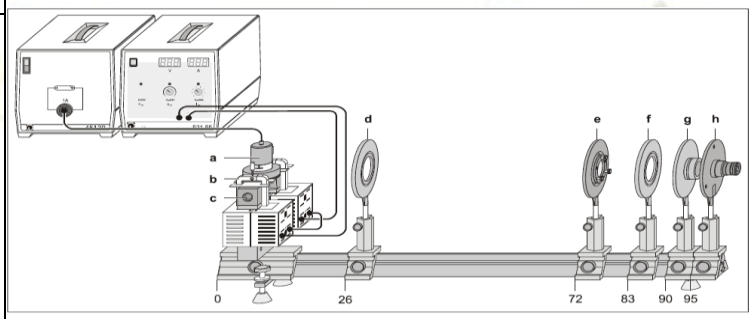
1. X-Ray device.
2. Balmer Series Spectroscopy
3. Zeeman effect
4. Planck's Constant
5. Franck–Hertz experiment
6. Millikan's experiment

Inside the lab, there is the first aid box and also the security and safety rules.
There are a technician's room and a store room in the lab.
Inside the lab, there is a smart board with a data show.
Lab's area is 8*6 m^2.

List of Experiments of Modern Physics Lab:

Device name	X-ray machine
Device Lab.:	Modern Physics
Device Aim: To characterize the different metallic and semicrystalline materials.	

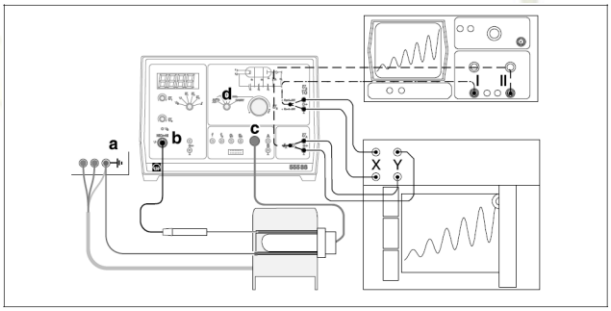
Device name	Balmer lamp
Device Lab.:	Modern Physics
Device Aim: Measuring the wavelengths Hα, Hβ and Hγ from the Balmer series.	

Device name	Cadmium lamp for Zeeman effect, Fabry-Perot etalon
Device Lab.:	Modern Physics
Device Aim: Observing the normal Zeeman effect in transverse and longitudinal configuration.	

Device name	Photoelectric effect
Device Lab.:	Modern Physics
Device Aim: To determine Planck's constant (h) using a photo-cell. To study the photoelectric voltages measured at different wavelengths and frequencies	

Device name	X-ray machine
Device Lab.:	Modern Physics
Device Aim: Record the x-ray spectrum of a molybdenum anode. Identify the continuous background and the characteristic K_α and K_β lines. Determie the energy of the characteristic spectrum	

Device name	Franck – Hertz Experiment
Device Lab.:	X-ray machine
Device Aim: To record Franck-Hertz curves for mercury and neon. To measure the discontinuous energy emission of free electrons for inelastic collision.	



Device name	Millikan oil drop experiment	
Device Lab.:	Modern Physics	
Device Aim: To demonstrate the quantization of electric charges and to determine the elementary charge of electron		

Solid State Physics Lab:

This lab aims to:
help the student to carry out a series of experiments to study some of the physical phenomena related to the knowledge that has been studied in parts of the theoretical solid state physics course as well as how to interpret the experimental results by using modern theories in the solid state physics.

Lab Experiments:

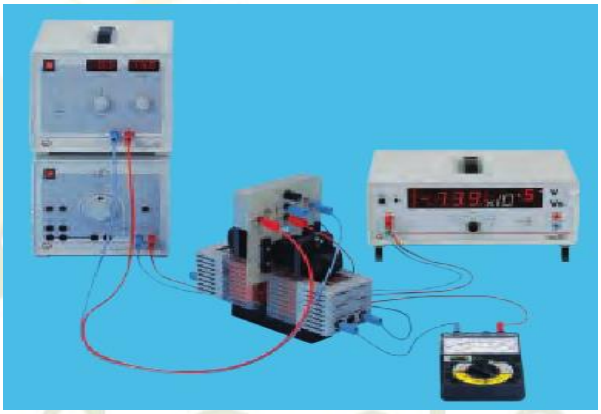
1. X-ray detection using ionization chamber.
2. Hall Effect.
3. Electric conductivity in solids.
4. Seebeck coefficient.
5. Conductors and semi-conductors and magnetization in an inhomogeneous magnetic field.
6. Determination of capillary constants of monocrystalls.
7. Solar cells.

Inside the lab, there is the first aid box and also the security and safety rules.
There are a technician's room and a store room in the lab.
Inside the lab, there is a smart board with a data show.
Lab's area is 8*6 m^2.

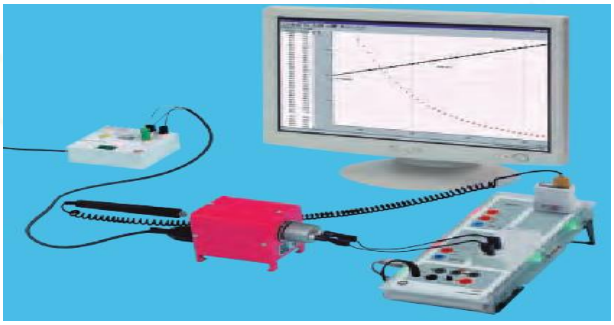
List of Experiments of Modern Physics Lab:

Device name	Detecting X-rays using an ionization chamber
Device Lab.:	Solid State
Device Aim: The aim of the experiment is to detect X-rays using an ionization chamber.	

Device name	Investigating the Hall effect in silver
Device Lab.:	Solid State
Device Aim: 1-Validation of the proportionality of the Hall voltage and the magnetic flux density. 2-Determining the polarity of the charge carriers. 3-Calculating the Hall constant RH and the charge carrier concentration n.	

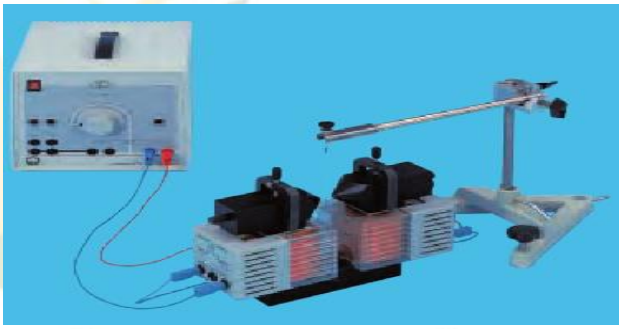


Device name	Electrical conduction in solid bodies
Device Lab.:	Solid State
Device Aim: Measuring the temperature dependency of a semi-conductor resistor	



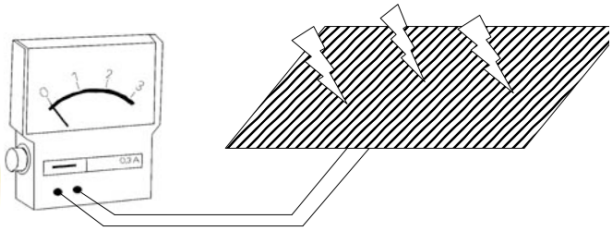
Device name	Thermoelectricity
Device Lab.:	Solid State
Device Aim: Seebeck effect: Determining the thermoelectric voltage as a function of the temperature differential.	

Device name	Dia-, para- and ferromagnetic materials in an inhomogeneous magnetic field
Device Lab.:	Solid State
Device Aim: Dia-, para- and ferromagnetic materials in an inhomogeneous magnetic field	



Device name	Determining the lattice constants of monocrystalls
Device Lab.:	Solid State
Device Aim: 1-Investigating and comparing Bragg reflection at an LiF and an NaCl monocrystal. 2- Determining the lattice constant a_0 of NaCl and LiF.	

Device name	Solar Cell
Device Lab.:	Solid State
Device Aim: To examine the relationships between lights and the electrical output of solar cells.	



Nuclear Physics Lab:

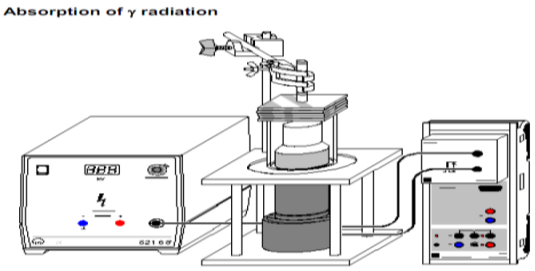
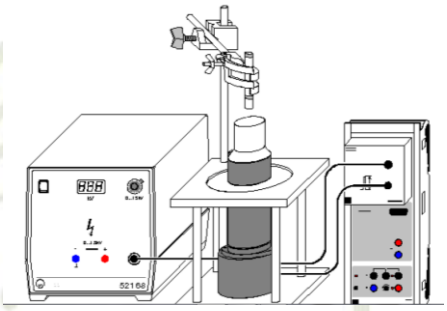
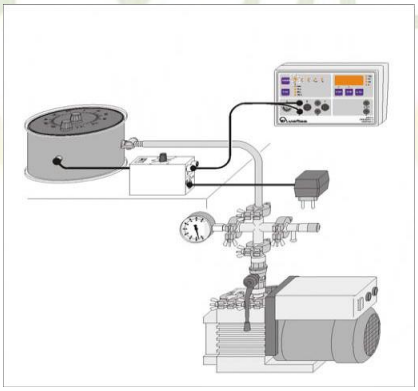
This lab aims to:
help the student to acquire the practical skills to measure the physical quantities related to the nucleus and nuclear radiation interactions with matter and investigation of the nuclear phenomena and theories.

Lab Experiments:

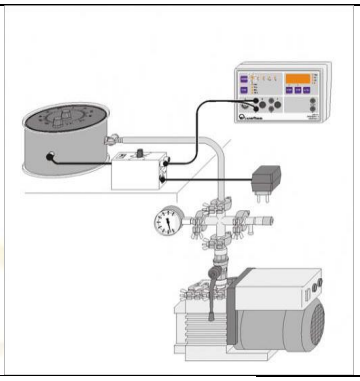
1- γ absorption using NaI(TI) detector.
2- γ spectrum using scintillation detector.
3- α spectroscopy in air.
4- Rutherford scattering.
5- Half-life time measurement of ^{137}Ba* using digital counter and PC.
6- β spectrum.
7- Statistical counting (Bose statistics).
8- Inverse square law for γ rays.
9- Compton scattering.

Inside the lab, there is the first aid box and also the security and safety rules.
There are a technician's room and a store room in the lab.
Inside the lab, there is a smart board with a data show.
Lab's area is 8*6 m^2.

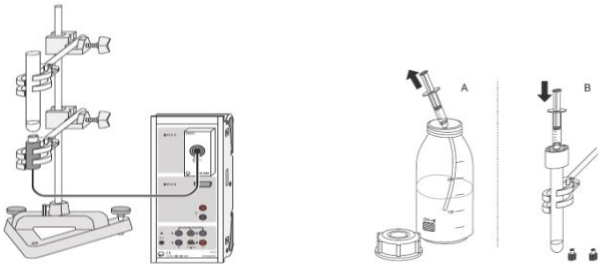
List of experiments of Nuclear Physics Lab:

Device name	Absorption of γ radiation by using the scintillation detector NaI(Tl)	
Device Lab.:	Nuclear Physics	
Device Aim: The aim of the experiment is to find the linear attenuation coefficient and the half-value depth.		
Device name	Recording and calibrating a γ −spectrum with a scintillation counter (137Cs)	
Device Lab.:	Nuclear Physics	
Device Aim : The γ −spectra of some standard preparations (^{137}Cs & ^{60}Co) are measured. After an energy calibration of the scintillation counter, the γ transitions are identified with the help of values quoted in the literature		
Device name	α −spectroscopy of radioactive samples (210Po) & Determining the energy loss of α −radiation in air	
Device Lab.:	Nuclear Physics	
Device Aim: The α −spectrum of the ^{210}Po preparation is recorded, and an energy calibration is carried out with known lines. The energy loss of the α −radiation from the ^{210}Po sample is measured in the scattering chamber independence on the air pressure.		

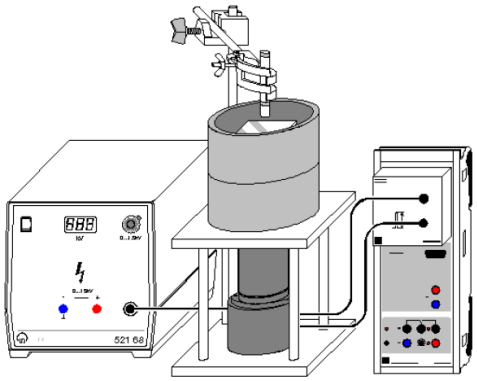
Device name	Rutherford scattering
Device Lab.:	Nuclear Physics
Device Aim: To record the direct counting rate of α particles scattered by a gold foil as function of the angle θ.	

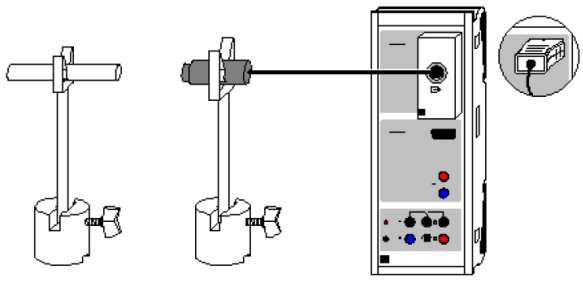
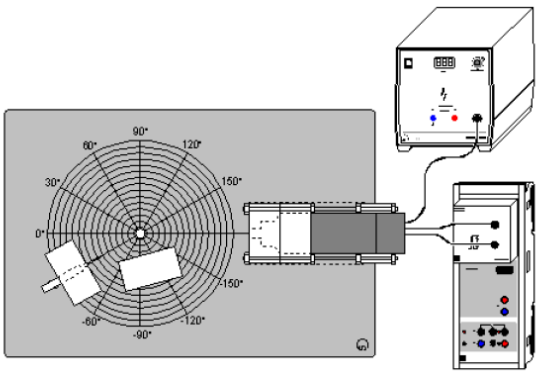


Device name	Elution
Device Lab.:	Nuclear Physics
Elution of the metastable $^{137}Ba^{*}$ isotopes from a ^{137}Cs preparation. Measuring the activity of the elute as a function of time and determining the half-life of $^{137}Ba^{*}$.	



Device name	Recording a β −spectrum using a scintillation counter
Device Lab.:	Nuclear Physics
Device Aim: The β − spectrum of ^{90}Sr is recorded with a scintillation counter. The energy loss per path length dE/dx of the β particles in aluminum is measured.	



Device name	**Poisson distribution**	
Device Lab.:	Nuclear Physics	
Device Aim: To study statistical variation in determining counting rates		
Device name	Law of distance and absorption of gamma or beta rays	
Device Lab.:	Nuclear Physics	
Device Aim : The inverse square law of distance is demonstrated with the gamma radiation from a ^{60}Co preparation, the half-value thickness and absorption Attenuation coefficient of different materials as a function of the material density		
Device name	Quantitative observation of the Compton effect	
Device Lab.:	Nuclear Physics	
Device Aim: An energy calibration of the scintillation counter is made. The energy distribution of γ quanta scattered in an aluminum scatterer is recorded for several angles between the source and the detector. From this the quantitative confirmation of the Compton effect is obtained.		