



Science & Robotics Training Lab



About SES

An Edtech industry leader and innovator, **SES Scientific Educational Systems**, goes above and beyond to supply educators and learners with the best educational systems, including **Neulog**, **Degem Systems**, **MultiCenter** and **MagiClass**.

Renowned for their ability to cater to numerous fields, sectors and segments, SES systems spread across a wide spectrum, offering unique solutions in the fields of **electronics, microcontrollers, telecommunication, autotronics, mechatronics, pneumatics, hydraulics, CNC machines, refrigeration and air-conditioning, green energy, computerized systems, science, robotics, logger sensors and STEM**.

Each proprietary SES system and device is perfectly designed and manufactured from the highest quality materials in accordance with all safety requirements and regulations. SES is a quality assured firm with the certification of ISO-9001:2015.

SES solutions are used in over 50 countries worldwide by professional developers for high-level technological commercial products and both governmental and private institutions covering educational programs for universities, colleges, vocational training centers and schools, high schools, junior high schools and primary schools.

NeuLog Science & Robotics

NeuLog Science & Robotics is a comprehensive set of logger sensors (over 50), connectivity (wire, Wi-Fi, Bluetooth) units to any computer platform, battery modules, robotics modules, control modules, coding units and more. All units and modules communicate with each other. It is most intuitive plug and play system.

NeuLog Science & Robotics comes with many experiments and exercises. Some of the experiments involve with science and robotics and enables to perform many research experiments like making measurements according to changes in a controlled system.

NeuLog Science & Robotics enables to implement a process control system such as temperature control, light control, irrigation in greenhouses and to check the effects on the plants, including remote control including alarm systems according to sensors.

NeuLog Science & Robotics enables the teacher giving the students problem to solve based on sensors and robotic units.

The knowledge acquired by **NeuLog Science & Robotics** enables even to ask the students to locate problems by themselves and to solve them.

The NeuLog platform for **Sciences and Robotics** allows executing different experiments based on the complete series of NeuLog sensors.

The NeuLog **Science and Robotics** platform allows scientific experiments to be programmed with visual blocks using the RobocklySense software.

The platform of NeuLog Sciences and Robotics with the programing modules in Blockly, Python and Language C, allows the student to leave the world of game and the scholastic world, to the professional world and with the preparation to the labor world.

NeuLog Logger sensors

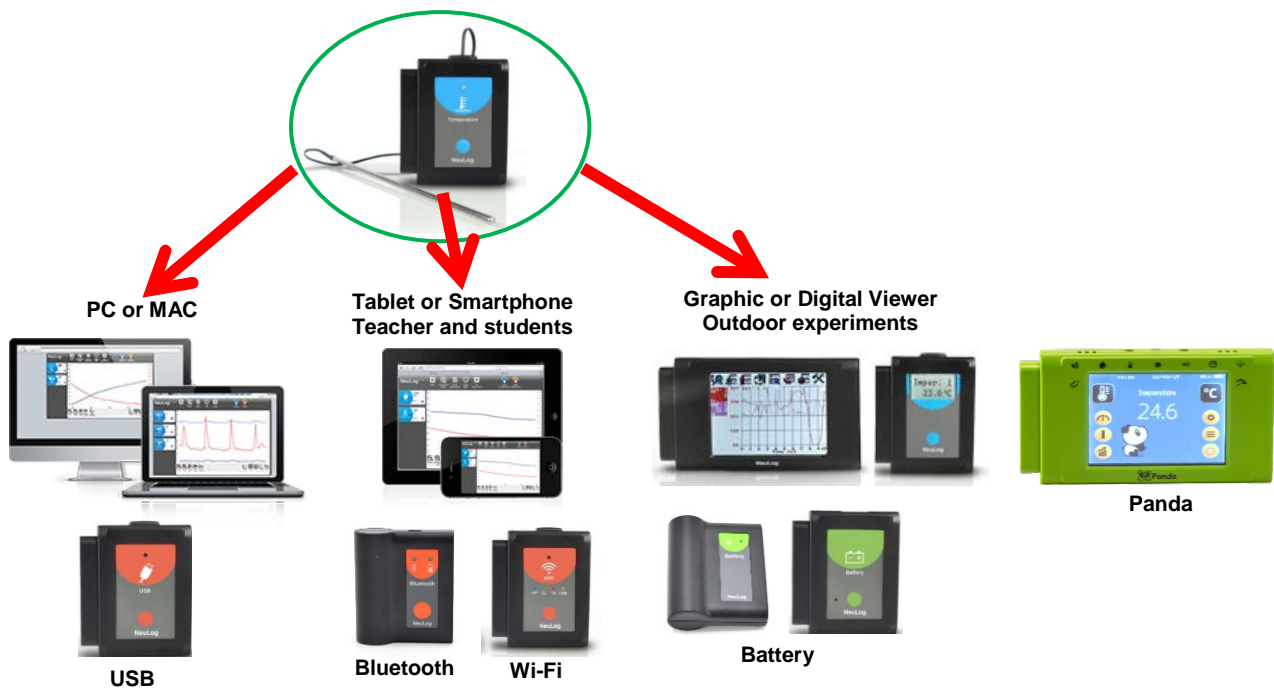
NeuLog has over 50 different sensors, which are all data loggers.

Each Sensor has a tiny computer, sampling the process and stores data.

Sensors are plugged into each another in a chain.

One software on any computer platform operates NeuLog Logger sensors.

More than 100 experiments are in **Neulog.com** site.



NeuLog software is most powerful and most intuitive.

Run experiment button brings up the Experiment setup screen.

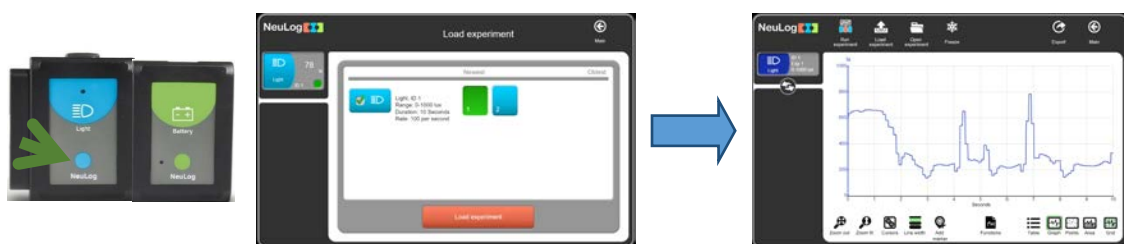
Record button runs the Experiment while displaying the results on graph.

Function button enables analyzing the results with high level mathematics.



Sensors can be connected to a battery module with or without viewer and used **outdoor** without a computer.

Each sensor can save up to 5 experiments in its memory which can be loaded to a computer.



'**Science Training Lab**' document describes NeuLog sensors, modules and kits.

NeuLog Sense Robotics

Sense Autonomous is a standalone modular robot with 6 built-in sensors (**5 range sensors** and **black line detector**) expandable with **Neulog sensors**, **IR Tracking unit**, **Brain Gripper** and more.

Add **BAT-202** for cordless movement.

Plug and code with **RobocklySense** on PC or MAC.



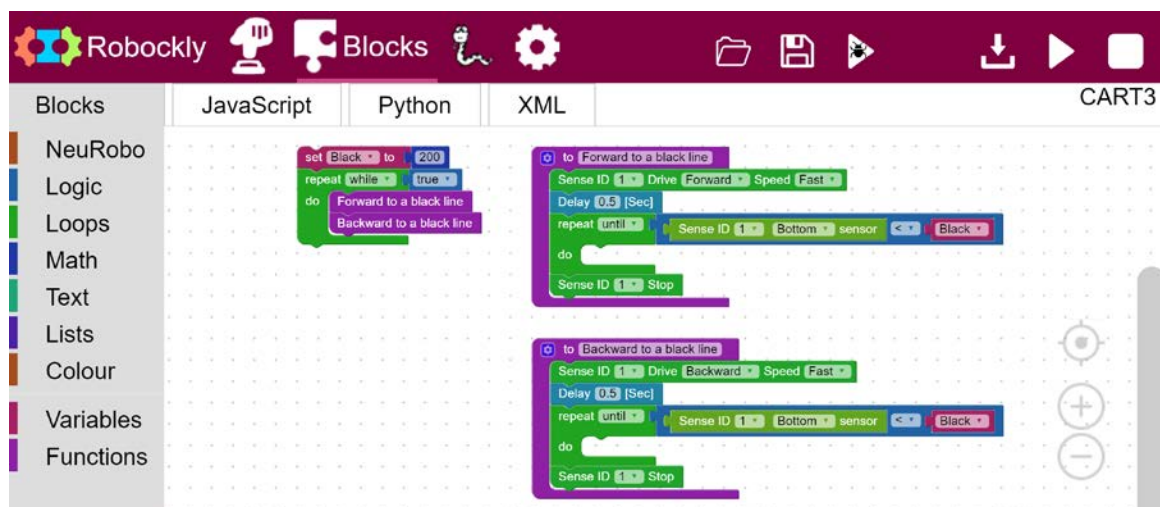
The **RobocklySense** is the best visual block-programming editor to start with. It is the most intuitive robotics software.

RobocklySense leads the students to program properly and to have good foundations.

The **RobocklySense** uses special blocks for NeuLog SENSE robots and controllers that read the inputs, operate the outputs and read any of the **NeuLog** sensors.

RobocklySense can run an science experiment with Neulog sensors while controlling the robot.

RobocklySense is available for free download at www.neulog.com.



Add extra coding unit for programming in **Robockly**, **Python**, **C language**, **C Arduino**.

The **Sense Autonomous** can be used as a USB module for the **NeuLog** sensors connected to it.










The **Sense Autonomous** builds innovation, creativity and coding skills. It comes with a study book composed of following units. Each unit has 15 lessons of 2 hours each.

1. **Robot coding and basic algorithms** – Principles of robotics, programming, movement algorithms, sensor reading, peripheral operation.
2. **Autonomous vehicles challenges** – This unit introduces several of the challenge autonomous exercises. The idea is to let the user to think about algorithms and solutions to solve these challenges.

'**Robotics Training Lab**' document describes NeuLog Sense robots, modules and kits.

NSR-1 NeuLog Science & Robotics set 1

NSR-1 is a set of NeuLog sensors and robotics modules, including the following:

Catalog No.	Module	Photographic image	Purpose
SENSE	Sense autonomous robot		An autonomous robot with 6 built-in sensors and sockets for other neuLog sensor and modules
BLT-202	Bluetooth module		Connects sensors and robots with computers and tablets using Bluetooth technology. Can be also used as NeuLog USB wire connection to PC. Includes 2300mAh rechargeable battery.
ROBO-206	Input / Output control module		A robotics controller for motors, lamps, buzzer and passive sensors and NeuLog sensors. Can be also used as NeuLog USB wire connection to PC.
RF-201	RF Communication Module		Enables wireless connection of logger sensors to PC or to robotic controller.
NUL-203	Temperature logger sensor		Measures temperature in °C and °F.
NUL-204	Light logger sensor		Measures level of Illumination in three ranges.
NUL-211	Force logger sensor		Measures forces, both push and pull.
NUL-212	Sound logger sensor		Measures sound level and waveforms.
NUL-213	Motion logger sensor		Measures distance, velocity and acceleration.

The system can be expanded with more sensors and robotic modules.

NSR-1 Science Experiments

Exp. No.	Experiment name	Sensor	Sensor name
P-1	Falling objects	NUL-213	Motion
P-2	Motion studies	NUL-213	Motion
P-3	Motion parameters of a moving cart	NUL-213	Motion
P-4	Newton's second law	NUL-213	Motion
P-5	Gravity acceleration on an inclined plane	NUL-213	Motion
P-6	Friction force	NUL-211	Force
P-7	Levers	NUL-211	Force
P-8	Pulley systems	NUL-211	Force
P-9	An inclined plane	NUL-211	Force
P-23	Light intensity and distance	NUL-204	Light
P-31a	Light absorption and heat	NUL-203	2 Temperature
P-40	Colors of light	NUL-204	Light
P-41	Light and shadow	NUL-204	Light
P-42	Light and dark colors	NUL-204	Light
P-19	Sound rate	NUL-212	2 Sound
P-21	Sound waves and musical notes	NUL-212	Sound
P-22	Sound beats	NUL-212	Sound
P-26	Exploring sound	NUL-212	Sound
P-29	Sound isolation	NUL-212	Sound
P-30	Tuning forks and resonance boxes	NUL-212	Sound
P-33	Sound waves	NUL-212	Sound
P-38	Thermal conductivity	NUL-203	Temperature
C-15	Distillation – part 1	NUL-203	Temperature
C-16	Distillation – part 2	NUL-203	Temperature
C-17	Evaporation	NUL-203	3 Temperature
C-18	Endothermic and exothermic reactions – part 1	NUL-203	Temperature
B-16	Measuring particles in air	NUL-204	Light

NSR-1 Robotics Experiments

Unit 1 – Robot coding and basic algorithms

Principles of robotics, programming, movement algorithms, sensor reading, peripheral operation.

No.	Title	Topics
1	Robot direct operation	Movement and sensors
2	First programs	Forward and backwards, Turning left and right, program download
3	Interactive programs	Memories and variables, black line sensor, Wait-Until command, endless loop
4	Procedures	Programs and procedures, Definitions, range sensor, between a wall a line, along black line
5	Conditions and decisions	If-Then command, OFF and ON with different values, AND condition, OR condition, along two lines, along walls
6	Counting	Using variables for counting black lines
7	Automatic movements	Movements with turns
8	Loops	Movements with turns and loops
9	Loops and procedures	Movements with loops and procedures
10	Sensing robot	'Do not touch me' robot
11	Robots in a convoy	Robots in a convoy on black line or around a box
12	Movement in a labyrinth	Exit a labyrinth
13	Exit a circle	Exit an open round black line
14	Along a wall	Along a wall using two range sensors
15	Along corridors	Along corridors with two side walls

Unit 2 – Advance algorithms for autonomous vehicles

This unit introduces several of the challenge autonomous exercises. The idea is to let the user to think about algorithms and solutions to solve these challenges.







No.	Title	Topics
1	Along black lines	Exploring the best way to move along a black line
2	AGV-Automatic Guided Vehicle	AGV goes along a black line and stops in front of a station
3	AGV between stations	AGV that moves from one station to another
4	Autonomous car along a building block	Exploring the best way to move along walls and around a block
5	Autonomous car along a building block and bypass cars	Moving around a block while passing obstacles
6	Autonomous car along a building block with stop sign	Moving around a block and waiting a little on black lines on the way
7	Autonomous car along a building block with stop for pedestrian	Moving around a block and waiting on a black line until the pedestrian crosses the street.
8	Autonomous building block guard robot	Moving around a block while counting corners
9	Autonomous two buildings guard robot	Moving around two blocks while counting corners
10	Autonomous museum guard robot	Moving through corridors and rooms
11	Autonomous taxi	Moving around a block while counting lines and stopping at a certain place
12	Autonomous taxi with passenger	Moving around a block while counting lines, stopping at a certain place and moving to another certain place
13	Home vacuum clean robot	Moving along a room's walls, close to and far from the walls
14	Free mission	Inventing and implementing robot mission
15	Free mission	Inventing and implementing robot mission

NSR-1 Science & Robotics Experiments

Robotics experiments with sensors, process and research experiments.

No.	Title	Topics
1	Brain units and sound sensor	Sound and dB, wait for a sound as a trigger
2	Motion sensor	Movement in distance range
3	Light sensor	Light sensor, movement to a light source
4	Temperature sensor	Temperature alarm system
5	Force sensor	Movement according to force sensor
6	Robot science experiment	Running sensor experiment while movement, light vs distance, magnetic field vs distance
7	Process control	Controlling outputs according to sensor inputs
8	Motion analyzing	Motion (distance, velocity and acceleration) analyzing using robot and motion sensor
9	Scanning walls	Mapping walls using distance sensor and robot
10	Free mission	Problem solving using sensors and robotic modules

Additional recommended sensors:

Catalog No.	Module	Photographic image	Purpose
NUL-221	Barometer logger sensor		Measures air pressure and altitude
NUL-229	Soil moisture logger sensor		Measures soil moisture
NUL-206	pH logger sensor		Measures pH
NUL-207	Relative Humidity logger sensor		Measures relative humidity
NUL-210	Pressure logger sensor		Measures gas or air pressure
NUL-215	Conductivity logger sensor		Measures solution conductivity

NeuLog Science & Robotics Expansion Options

NeuLog Science & Robotics units use the same communication protocol. They can be expanded with the following coding units.

WIFI-203 – Wireless Python and Blockly coding unit

WIFI-203 is an embedded Linux controller. It is a Wi-Fi module housed in a rigid plastic packaging with colored label.

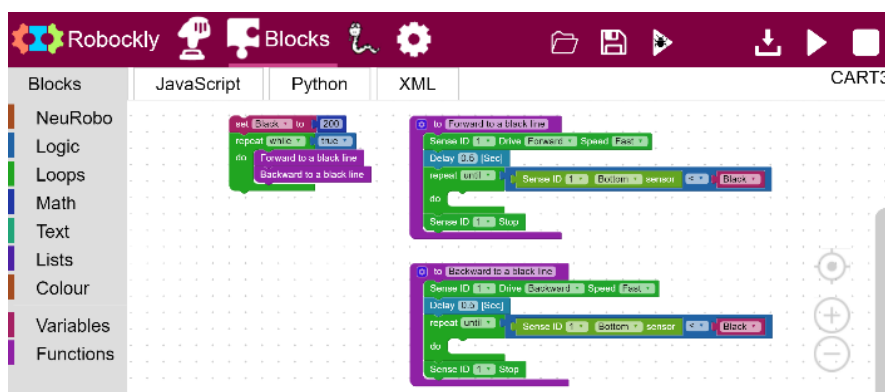
The module works wirelessly with any computer platform: computers, tablets, IPADs and smart phones.

The module has two connectors for communication with NeuLog sensors or with brain I/O units. The module includes flash memory used as hard disk for program files.



Programming languages: **Python** and **Robockly**.

Robockly has **Blockly** (Google program) instructions, enhanced with **SENSE** and **NeuLog** instructions.



It has rich instruction sets such as loops, logic, mathematics, functions, arrays, text and variables.

The **Robockly** uses special blocks for NeuLog SENSE robots and controllers that read the inputs, operate the outputs and read any of the **NeuLog** sensors.

The **Python** is one of the most popular high-level programming languages that works on any computer platform.

```
Black = None

def Forward_to_a_black_line():
    global Black
    sense_drive( id=1, command="forward", speed="fast" )
    delay_sec(0.5)
    while not (sense_get_input( id=1, input="bottom" )) < Black:
        pass
    sense_stop( id=1 )

def Backward_to_a_black_line():
    global Black
    sense_drive( id=1, command="backward", speed="fast" )
    delay_sec(0.5)
    while not (sense_get_input( id=1, input="bottom" )) < Black:
        pass
    sense_stop( id=1 )

Black = 200
while True:
    Forward_to_a_black_line()
    Backward_to_a_black_line()
```

It is excellent for programs with many functions and procedures that are limited in visual block programming languages.

WIFI-203 comes with **Sense Autonomous** experimental book for **Robockly** and **Python**.

CARM-202 – C language coding unit

CARM-202 is a C language coding unit with 8 switches and 8 LEDs housed in a rigid plastic packaging and colored label.

CARM-202 can be also used as a stand-alone module for ARM microcontroller and for C language programming.

Programming languages: **C language**.

C is a coding language for creating machine programs.

These machine programs are fast and work directly with the system hardware components and not through interpreters as the programs above do.

The industry needs C programmers for microcontroller machine programs. These programs are loaded into the microcontroller Flash memory and do not need any mediate program.

CARM-202 is also a training system for C language and **ARM** microcontroller (the most popular microcontroller in the world).

CARM-202 comes with two books.

One book is C language and **ARM** theory and experimental book.

The second book is a **Sense Autonomous** experimental book for C – language.



```
int main (void)
{
    float  BLACK = 250;
    float  VAL;

    NVIC_SetVectorTable(NVIC_VectTab_FLASH,
    INTERRUPT_VECTOR_START);
    USART1_Interrupt_Init();
    __enable_irq(); // (Enable Interrupts)

    Send_AT_Command("AT+SetSpeed:[Sense],[1],[0],[150]");
    //Set Sense speed
    Send_AT_Command("AT+SetMotor:[Sense],[1],[0],[Cw]");
    //Sense forward

    VAL = 900;
    while(VAL > BLACK)
    {
        Send_AT_Command("AT+GetInput:[Sense],[1],[1]");

        if((stringComplete)&&(inputString[0]           !=
        'F')&&(inputString[1] != 'a'))
        {
            InputString_to_val(); //update inputStringVal
            VAL = inputStringVal;
        }
    }
}
```

COM-202 – Adapter for Arduino and Raspberry Pi units

COM-202 is an adapter card for the **Arduino** or **Raspberry Pi** units plugged into one of the system's connectors (NeuLog sensor, SENSE robot or brain unit base) and through it to all the system's units.



The COM-202 card includes outlet wires for connecting to the communication and power terminals of the Arduino coding cards.

COM-202 comes with software functions that enable communicating with all the system units.

Programming languages: **Arduino C.**

Arduino is very popular units for project developments. It is based on coding and accessory cards.

In order to make the programming simple, the coding cards include special built in loading and running the user programs.

NeuLog Science & Robotics Projects

NeuLog Science & Robotics units are excellent for science and technology research and development. NeuLog sensors supply processed data to the controller (temperature in °C or °F, light in Lux, force in Newton, etc.). Together with the robotics modules (especially ROBO-206) they enable any student to concentrate on the research and the programming and not on the electronics aspects.

In Israel hundreds of research and development projects are done. Many of them are led by doctors from hospitals, professors from universities and engineers from the industry.

The following are some of the last year projects:

No.	Project description	NeuLog units
1	Washing need alarm for an incapacitated patient in hospital	Temperature, conductivity, ROBO-206
2	Fitness facility remote report	2 x hand dynamometer, force, 2 x RF, USB
3	Baby heart stress test by measurements in his eating bottle	Force, pressure, pulse, USB
4	Checking sails	2 x Force, anemometer, ROBO-206
5	Downfall from a surfboard alarm	Force, conductivity, GPS, distance, RF, USB
6	Checking drones	Force, battery, USB
7	Leakage in drain pipes alarm	Pressure, flow, USB
8	Water dripper research	Pressure, flow, USB
9	Tourniquet trainer	Hand dynamometer, flow, pressure, ROBO-206
10	Lungs check	Spirometer, pressure, USB

SES Training LABs

The training labs are based on learning-by-doing, which makes the students learn more quickly and remember what they have studied by performing practical experiments. They provide the students high profession skills and the knowledge on how to improve their chance of employment and earning capacity.

The manuals and courseware that accompany each course provide the theory background and experiments.

Electronics Training Lab

This modular laboratory is aimed for the **Electronics** profession, but also for technology disciplines that are also based in electronics, such as: **Electricity, Mechanics, Automotive, Robotics, Automation, Process control.**

Autotronics Training Lab

This modular laboratory is aimed for the five stages that comprise the automotive program: **Basic and automotive electronics, Car sub-systems simulators, Car sub-systems demonstrators, Car diagnostic and troubleshooting methods, Troubleshooting faults in a real car.**

Mechatronics Training Lab

This modular laboratory is aimed for the mechatronics program which includes the following disciplines: **Basic electronics, Pneumatics systems, Hydraulics systems, CNC machines.**

Refrigeration and Air-Conditioning Training Lab

The Refrigeration and Air-Conditioning training lab covers actual components and their interconnection, related functions, operation, diagnosis and repair methods through safe, hands-on practical activities.

Technology Preparation Training Lab

The Technology Preparation (Tech Prep) laboratory is a classroom-integrated laboratory consisting of educational modules covering a wide range of subjects such as: **Green energy, Computerized systems, Basic electronics, Basic communication, Mechanical systems.**

Science Training Labs

These laboratories (for primary, secondary and high schools) introduce the students to the computerized sensors world, **nature and industry processes** and **nature laws**. It will help them understand modern technologies such as: **home and medical appliances, wearing sensors, precise agriculture** and more.

Robotics Training Labs

The robotics programs (for primary, secondary and high schools) help students to build innovation and creativity skills. The idea is to make the students understand how systems work, to believe that they can improve them and be able to realize their ideas.

MultiCenter Training Lab

The MultiCenter offers a variety of selected interactive learning environments, with a large range of topics and activities such as: **Science, Technology, Graphic Design, Digital Music, Robotics, Computer Technologies** and much more for all sectors of society, cultures, different socio-economic groups and different age groups – from very young children to senior citizens.



Our Training Labs:

SCIENCE

ROBOTICS

ELECTRONICS

ELECTRICITY

TELECOMMUNICATION

AUTOTRONICS

MECHATRONICS

MULTICENTER

SCIENCE & ROBOTICS

TECHNOLOGY PREPARATION

REFRIGERATION & AIR-CONDITIONING

SCIENCE & ROBOTICS