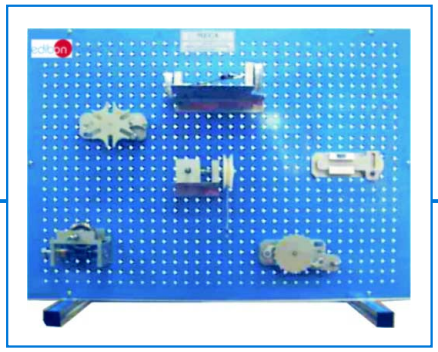
edibon
Technical Teaching Equipment

Basic Mechanics Integrated Laboratory

LIMEBA

Laboratory structure

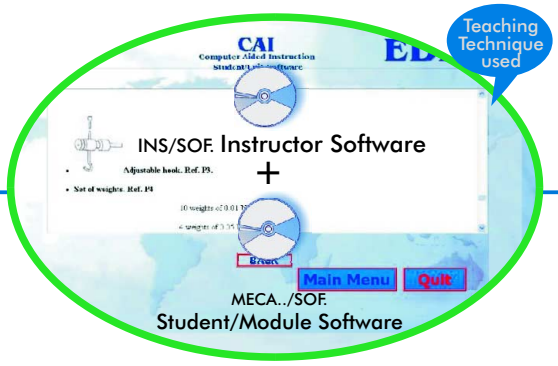
① Base Panel
(support for the elements of the modules)



② Modules

② Modules

③ **CAI.** Computer Aided Instruction Software System



④ **LIMEBA/CAL.** Computer Aided Learning Software
(Results Calculation and Analysis)

The complete laboratory includes parts 1 to 4 but any part can be supplied individually or additionally to others. (Base Panel + Module/s is the minimum supply).

Some available Modules

- MECA1. Statics Experiments.
- MECA2. Load Elevation Mechanisms Experiments.
- MECA3. Transmissions Experiments.
- MECA4. Dynamics Experiments.
- MECA5. Friction Experiments.
- MECA6. Special Mechanisms Experiments.

ISO:9001-2000 Certificate of Approval. Reg. No. E204034

European Union Certificate

Certificates ISO 14001: 2004 and ECO-Management and Audit Scheme
(environmental management)

Worlddidac Quality Charter Certificate
Worlddidac Member

INTRODUCTION

LIMEBA consists on a complete set of exercises and practical experiments belonging to the area of Applied Mechanics in its two main subareas: Statics (the analysis of structures in balance) and Dynamics (analysis of the motion of mechanisms). LIMEBA is divided into various experimental modules, each one presenting a subject of Statics or Dynamics.

GENERAL DESCRIPTION

Students are expected to build the experiments on the base panel, where distance measurements are possible due to equidistant spacings between holes on the base panel.
Thanks to the Manuals and the necessary theoretical knowledge imparted by the teacher, students shall be able to do all the measurements.
The MECA series is split up into six parts, named Modules, each of which contains the elements needed for completing a specific group of related exercises and experiments.

What are the parts included in the laboratory?:

① Base Panel:

It is the supporting structure where the modules's elements are mounted in order to undertake the experiments and hence, the base panel is necessary along with any module.
The panel is pierced with equidistant holes that help students to take measurements.

② Modules:

Each module is formed by different experiment components and is packed in a high quality case.
The experimental elements of each module are made out of special anodized aluminium, a high quality material to achieve total precision and to obtain 100% accuracy in carried out practices.
Manuals include laboratory sheets for every experiment, listing the elements needed in every experiment and giving the correct position of each element on the base panel. These sheets also give valuable guidance on how to conduct the experiments and recording the results.
There is a particular manual for each Module. (8 manuals normally supplied).
Accessories included for a normal working operation.

There are six different modules:

- MECA1. Statics Experiments.
- MECA2. Load Elevation Mechanisms Experiments.
- MECA3. Transmissions Experiments.
- MECA4. Dynamics Experiments.
- MECA5. Friction Experiments.
- MECA6. Special Mechanisms Experiments.

③ CAI. Computer Aided Instruction Software System:

The best help in classroom for both teacher and students.
Includes:

3.1) INSTRUCTOR SOFTWARE: INS/SOF. Classroom Management Software Package (Instructor Software).
Only one package is needed per classroom.
Helps creating databases, reports and statistical comparisons among many more features.

3.2) STUDENT SOFTWARE: MECA./SOF. Computer Aided Instruction Software Packages (Student/Module Software).
Each "MECA" type module has its own package.
It gives the students the proper assistance on theoretical knowledge as well as in practice, presenting exercises and questions.

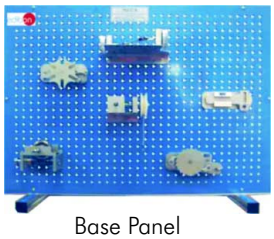
④ LIMEBA/CAL. Computer Aided Learning Software (Results Calculation and Analysis):

Windows, based software, simple and easy to use, specifically developed for use with EDIBON Basic Mechanics Modules.

Complete LIMEBA LABORATORY included: ① + ② + ③ + ④
Minimum supply: ① Base Panel + ② Modules

Working possibilities:

A) CAI/LIMEBA/CAL working possibility (complete EDIBON system)



Base Panel

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Modules

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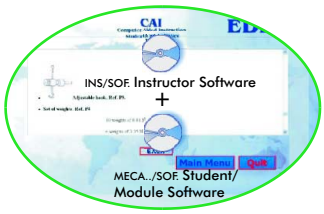

CAI
Computer Aided
Instruction Software System

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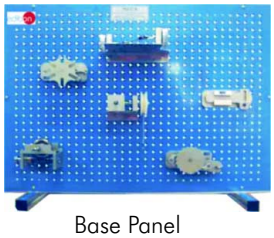
LIMEBA/CAL
Computer Aided Learning Software
(Results Calculation and Analysis)

B) CAI working possibility



Base Panel

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Modules

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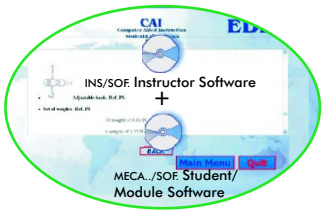
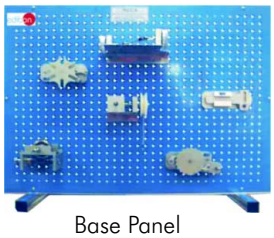


CAI
Computer Aided
Instruction Software System

C) LIMEBA/CAL working possibility



Base Panel

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Modules

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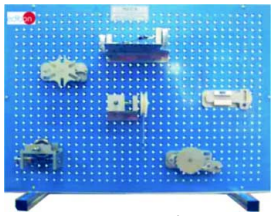
LIMEBA/CAL
Computer Aided Learning Software
(Results Calculation and Analysis)

D) Simplest working possibility



Base Panel

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Modules

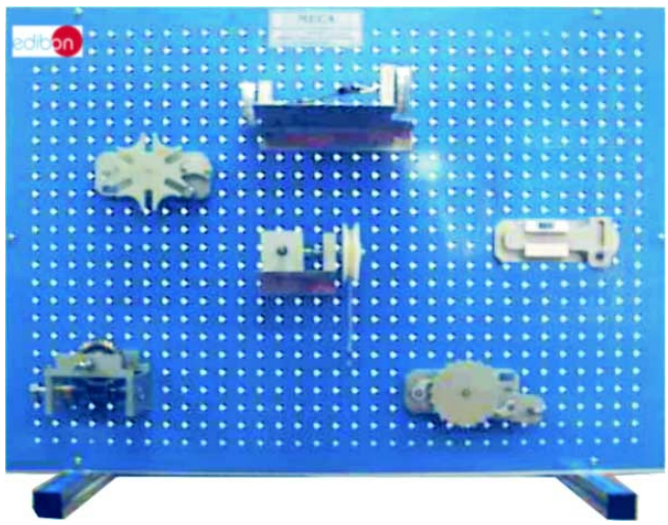
① Base Panel

SPECIFICATIONS

Anodized aluminium structure.

Front Panel in painted steel.

The holes on the base panel are accurately spaced at 25mm centres.



DIMENSIONS AND WEIGHT

Dimensions: 950 x 400 x 550 mm. approx.

Weight: 15 Kg. approx.

MECA1 Statics Experiments

DESCRIPTION

Statics is the part of Mechanics that studies any kind of structure or element in balance-equilibrium. Basically the module consist on experiments in which the student shall learn to deduce the main principles of Statics and its most important applications.

PRACTICAL POSSIBILITIES

1.-**Centres of gravity** (Centres of gravity (I) and Centres of gravity (II)): Specification of the centre of gravity of plates of different shapes using the simple pendulum and graphical methods.
2.-**Triangle of forces.** To test that three non-parallel forces in equilibrium acting in the same plane can be represented by a Triangle of forces.
3.-**Parallelogram of forces.** When three non-parallel forces in the same plane are in equilibrium, their lines of action meet at a point, and hence to show that the resultant of two forces can be found using the Parallelogram of forces.
4.-**Polygon of forces.** Verification of the fact that four or more forces in equilibrium acting on the same point, can be represented by a Polygon of forces.
5.-**Principle of moments.** Verification of the principle of moments for parallel and non parallel forces.
6.-**The Pivot or beam balance.** To demonstrate that the action of weighing with a beam balance or slide balance is based upon the principle of moments.
7.-**Levers:** To determine the mechanical advantage of various types of levers using the ratio resistance/power (W/P) and to verify that this is the same as the ratio between distances.
8.-**Beam reaction forces.** Verification of the fact that a distributed load applied over a beam may be considered as an equivalent concentrated load applied at the centre of gravity of the distributed load. Reactions located at supports due to the load acting on the simply supported beam may be calculated using the momentum principle, independent of the position of these beam supports.

SPECIFICATIONS

All experiment elements are made in special anodized aluminium.
Centres of gravity of various shaped plates:
- Rectangle.
- Circle.
- Triangle.
- T.
- Kite.
- Irregular.

Drawing panel.
3 Cords and ring.
5 Cords and ring.
Beam balance.
Beam.
2 forces equality divided.
The simple pendulum.
Pivot screw.
Adjustable hooks.
Set of weights:
- 10 weights of 0.01 N.
- 4 weights of 0.05 N.
- 10 weights of 0.1 N.
- 2 weights of 0.5 N.
- 4 weights of 1 N.
- 2 weights of 2 N.
- 1 weight of 5 N.

Weight hooks.
Light weight hooks.
Pulleys.
Screws.
Knurled nuts.
Large ext. spring.
Small ext. spring.
Dynamometer.
Spare rope.

DIMENSIONS AND WEIGHT

Dimensions: 500 x 360 x 120 mm. approx
Weight: 5 Kg. Approx

SERVICES REQUIRED

Base Panel.

MECA2 Load Elevation Mechanisms Experiments

DESCRIPTION

Experimenting with the main mechanisms used for load elevation. Analysis of their work and efficiency.

PRACTICAL POSSIBILITIES

1.-**Simple pulleys.** Verification of the variation of cable tension in a pulley with the cable's direction as it passes over the pulley. To determine the mechanical advantages of a simple combination of fixed and movable pulleys.
2.-**Pulley blocks.** Analysis of the mechanical features of a set of pulley blocks, which has three sheaves in the upper block and two pulleys in the lower block.
3.-**Single axle and wheel.** Determine the law of the Machine for a simple axle and wheel, and the variation of mechanical advantage and efficiency with load.
4.-**Differential axle and wheel.** Determine the law of the Machine for differential axle and wheel. Verification that the mechanical advantage and efficiency increases with load up to a limiting maximum.
5.-**Weston differential chain blocks.** Analysis of the specific characteristics of these chains.
6.-**Screw Jack.** To measure the effort required to raise various loads using a simple form of screw jack and to determine how the mechanical advantage and efficiency varies with load.

SPECIFICATIONS

All experiment elements are made in special anodized aluminium.
Three pulley block.
Two pulley block.
Wheel and axle set.
Weston differential chain block.
Screw jack.
Support screw.
Adjustable hooks.
Set of weights:
- 10 weights of 0.01 N.
- 4 weights of 0.05 N.
- 10 weights of 0.1 N.
- 2 weights of 0.5 N.
- 4 weights of 1 N.
- 2 weights of 2 N.
- 1 weight of 5 N.

Weight hooks.
Light weight hook.
Pulleys.
Adjustable pulley.
Single pulley block.
Knurled nuts.
Dynamometer.
Spare rope.
Screws.

DIMENSIONS AND WEIGHT

Dimensions: 500 x 360 x 120 mm. approx.
Weight: 9 Kg. approx.

SERVICES REQUIRED

Base Panel.

MECA3 **Transmissions Experiments**

DESCRIPTION

Most recent machines require the transmission of motion between elements to obtain the desired mechanical result. The mechanisms studied in this module are those that transmit motion between two axles.

PRACTICAL POSSIBILITIES

1.-**Belt drive** (Belt drive (I) and Belt drive (II): Verification of the direction of rotation of open and crossed belt drives. Verification of the speed of rotation of the two pulleys is inversely proportional to their diameters. To measure the difference intension between the two sides of a belt drive and to determine the efficiency of drive transmission.
2.-**Chain drive.** Verification of the speed ratio of a chain drive. Measurement of the efficiency of drive transmission.
3.-**The Geared winch** (two parallel axles). Comparison of the velocity ratios of a system of single-stage and double-stage geared winch. Specification of their corresponding mechanical advantages and efficiencies under varying loads.
4.-**Bevel gears** (two intersecting axles). Verification of the efficiency velocity-ratio and mechanical advantages of the Bevel gear unit under different loads.
5.-**Worm gear** (two crossed axles). Verification of the speed ratio of a worm and specification of the transmission efficiency under different loads.
6.-**Universal coupling.** To investigate the effect of introducing universal coupling to a simple drive shaft.

SPECIFICATIONS

All experiment elements are made in special anodized aluminium.
System of belt drive (includes: flat belt, round belt and leather strip).
Chain drive.
Simple gear train.
Bevel gears.
Worm gear.
Universal coupling.
Support screw.
Adjustable screws.
Set of weights:
10 weights of 0.01 N.
4 weights of 0.05 N.
10 weights of 0.1 N.
2 weights of 0.5 N.
4 weights of 1 N.
2 weights of 2 N.
1 weight of 5 N.
Weight hooks.
Light weight hooks.
Pulley.
Screws.
Knurled nuts.
Dynamometers.
Spare rope.

DIMENSIONS AND WEIGHT

Dimensions: 500 x 360 x 120 mm. approx.
Weight: 7 Kg. approx.

SERVICES REQUIRED

Base Panel.

MECA4 **Dynamics Experiments**

DESCRIPTION

Dynamics is the part of Mechanics that analyzes the motion of an element or mechanism caused by a force. Thus the study is concentrated on the basic laws of Dynamics.

PRACTICAL POSSIBILITIES

1.-**Spring balance.** To verify that the extension of a coiled spring is proportional to the load applied, to show the principle of a spring balance.
2.-**Simple pendulum.** To show that the time of a simple pendulum depends only on the length of the pendulum, and to determine the value of the force of gravity using a simple pendulum.
3.-**Kinetic and potential energy.** Analysis of some features of kinetic and potential energy and to show that energy exists, that is may be transformed, and that it may be "stored" and "given back" .
4.-**Inertia.** The wheel. To find the energy stores in a wheel by supplying a known quantity of energy .
5.-**Centrifugal force.** Demonstration of the laws of the centrifugal force.

SPECIFICATIONS

All experiment elements are made in special anodized aluminium.
The spring balance.
Wheel.
Centrifugal force system.
The simple pendulum.
Adjustable screw.
Set of weights:
10 weights of 0.01 N.
4 weights of 0.05 N.
10 weights of 0.1 N.
2 weights of 0.5 N.
4 weights of 1 N.
2 weights of 2 N.
1 weight of 5 N.
Weight hooks.
Adjustable pulley.
Screws.
Knurled nuts.
Small ext. spring.
Large ext. spring.
Dynamometer.
Spare rope.

DIMENSIONS AND WEIGHT

Dimensions: 500 x 360 x 120 mm. approx.
Weight: 7 Kg. approx.

SERVICES REQUIRED

Base Panel.

MECA5 Friction Experiments

DESCRIPTION

This module considers the most important phenomenon of Dynamics: Friction. It is a manifestation of the energy loss due to contact, effect that happens in every real-world mechanism.

PRACTICAL POSSIBILITIES

1.-**Sliding friction.** Verification of the laws of friction and to measure the coefficient of friction for different materials.
2.-**Inclined plane** (Inclined plane (I) and Inclined plane (II)). Analysis of the forces acting on an inclined plane due to a weighted of a roller supported on the plane. Calculation of the starting force needed for dragging a block on the plane.
3.-**Angle of friction.** Measurement of the angle of friction and from it find the coefficient of friction. To show that the coefficient of friction is equal to tangent of the angle of friction.
4.-**Friction.** To show the extent to which friction is reduced by using wheels and rollers and to compare the effects of different bearing surfaces.
5.-**The wedge.** Determine mechanical advantage and efficiency obtained using two different wedges, and to show that overhauling may be prevented if the angle of inclination of a wedge is small.
6.-**Bearings.** Comparison of the resistance to turning due to friction of four bearings made of different materials, and to show something of the progress made in bearing development.

SPECIFICATIONS

All experiment elements are made in special and anodized aluminium.
Friction equipment.
Friction with roar.
Foils of friction.
Roller.
Block of wheels with roar.
Set of rollers in a marc.
Principle of wedge.
Bearings.
The simple pendulum.
Set of weights:
- **10 weights of 0.01 N.**
- **4 weights of 0.05 N.**
- **10 weights of 0.1 N.**
- **2 weights of 0.5 N.**
- **4 weights of 1 N.**
- **2 weights of 2 N.**
- **1 weight of 5 N.**

Weight hooks.
Light weight hook.
Pulley.
Adjustable pulley.
Single pulley block.
Screws.
Knurled nuts.
Dynamometer.
Spare rope.

DIMENSIONS AND WEIGHT

Dimensions: 500 x 360 x 120 mm. approx.
Weight: 6 Kg. approx.

REQUIRED SERVICES

Base Panel.

MECA6 Special Mechanisms Experiments

DESCRIPTION

This module considers various mechanisms frequently used in industrial processes; without them some operations would not be possible with the same efficiency. Here these mechanisms are shown and their function analyzed.

PRACTICAL POSSIBILITIES

1.-**Cam and roller.** To study the difference aspects of cam design.
2.-**Geneva motion.** Verification of how the circular motion of the drive unit is transformed into the intermittent motion of the Geneva motion, and of how this mechanism accelerates and decelerates during the transmission process.
3.-**Ratchet mechanisms.** Examination of the parts of the Ratchet assembly supplied in which a swinging lever is fitted with two pawls.
4.-**Scotch yoke.** Analysis and verification of the motion of a driving crank and its relation to the reciprocal element of motion.
5.-**Crank mechanism.** Analysis of the features of a crank mechanism, drawing a rotation torque diagram and deducing the relation between the crank rotation and the slide platform movement.
6.-**Quick return mechanism.** To show a quick return mechanism at work and to record the relationship between the rotation of the crank and the movement of the slide.

SPECIFICATIONS

All experiment elements are made in special and anodized aluminium.
The cam and roller mechanisms (included two cams).
Geneva mechanism.
The ratchet mechanisms.
Scotch yoke.
Crank mechanism.
Quick return mechanism.
Adjustable hooks.
Set of weights:
- **10 weights of 0.01 N.**
- **4 weights of 0.05 N.**
- **10 weights of 0.1 N.**
- **2 weights of 0.5 N.**
- **4 weights of 1 N.**
- **2 weights of 2 N.**
- **1 weight of 5 N.**

Weight hooks.
Adjustable pulley.
Screws.
Knurled nuts.
Dynamometer.

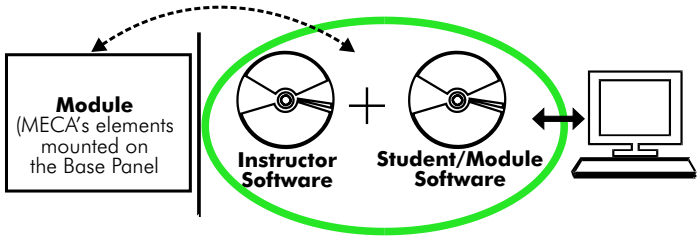
DIMENSIONS AND WEIGHT

Dimensions: 500 x 360 x 120 mm. approx.
Weight: 7 Kg. approx.

REQUIRED SERVICES

Base Panel.

③ CAI. Computer Aided Instruction Software System



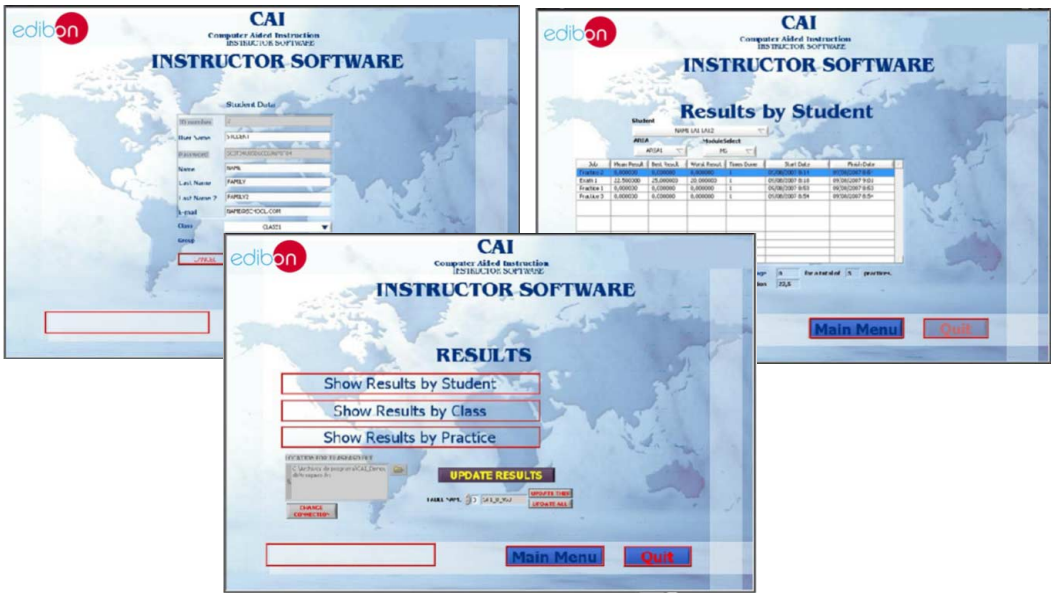
With no physical connection between module and computer, this complete package consists on an Instructor Software (INS/SOF) totally integrated with the Student/Module Software (MECA../SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students. These, on the other hand, get a virtual instructor who helps them to deal with all the information on the subject of study.

With the **INS/SOF. Classroom Management Software Package (Instructor Software)**, the Teacher has a whole range of options, among them:

- Organize Students by Classes and Groups.
- Create easily new entries or delete them.
- Create data bases with student information.
- Analyze results and make statistical comparisons.
- Print reports.
- Develop own examinations.
- Detect student's progress and difficulties.

...and many other facilities.

The Instructor Software is the same for all the modules, and working in network configuration, allows controlling all the students in the classroom.



MECA../SOF. Computer Aided Instruction Software Packages (Student/Module Software).

It explains how to use the module, run the experiments and what to do at any moment.

Each module has its own Student Software package.

- The options are presented by pull-down menus and pop-up windows.
- Each Software Package contains:

  Theory: that gives the student the theoretical background for a total understanding of the studied subject.

  Exercises: divided by thematic areas and chapters to check out that the theory has been understood.

  Guided Practices: presents several practices to be done, alongside the modules, showing how to complete the lab exercises and get the right information from them.

  Exams: set of questions presented to test the obtained knowledge.

∗ Both Instructor Software and Student/Module Software are available in English and Spanish. Any other language available on request.

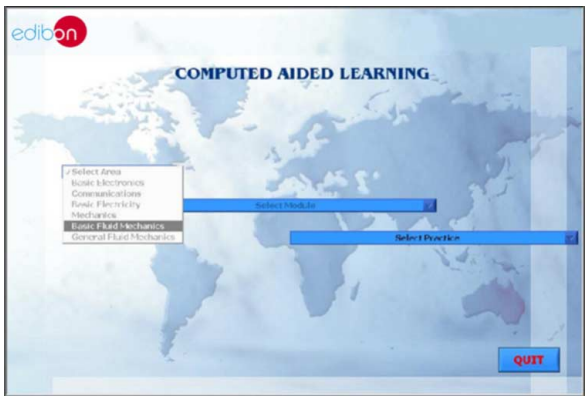
<u>Available Student/Module Software Packages:</u>

- MECA1/SOF. **Statics.**
- MECA2/SOF. **Load Elevation Mechanisms.**
- MECA3/SOF. **Transmissions.**
- MECA4/SOF. **Dynamics.**
- MECA5/SOF. **Friction.**
- MECA6/SOF. **Special Mechanisms.**

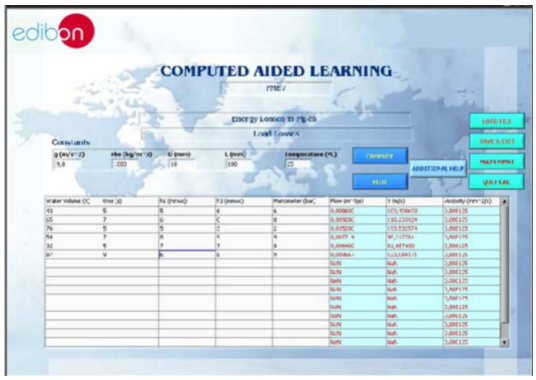
④ LIMEBA/CAL. Computer Aided Learning Software (Results Calculation and Analysis)

This Computer Aided Learning Software (CAL) is a Windows based software, simple and very easy to use specifically developed by EDIBON. It has been designed to cover different areas of science: Basis Electronics, Communications, Basic Electricity, Mechanics, Basic Fluid Mechanics and General Fluid Mechanics*.
*Although only the purchased areas will be activated and ready to use.

CAL is a class assistant that helps making the necessary calculations to extract the right conclusions from data obtained during the experimental practices.
With a single click, CAL computes the value of all the variables involved.
Also, CAL gives the option of plotting and printing the results.



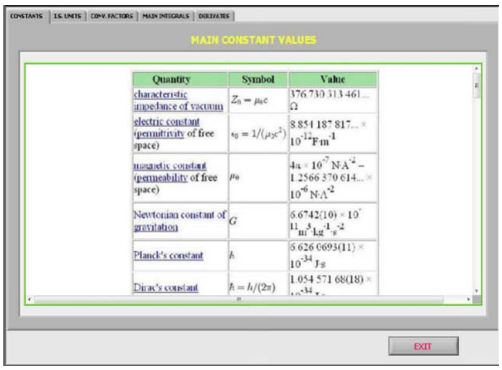
Once the Area of study is selected, the right module can be chosen among a wide range, each one with its own set of lab exercises.



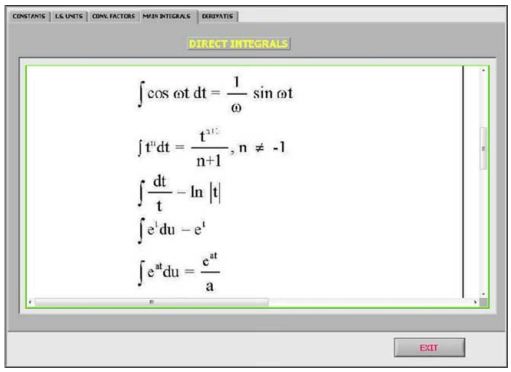
Simply insert the experimental data, with a single click CAL will perform the calculations.

Between the plotting options, any variable can be represented against any other.
And there exist a great range of different plotting displays.

Among the given choices, an additional help button can be found, which offers a wide range of information, such as constant values, unit conversion factors and integral and derivative tables.



It includes a handy option to avoid using different reference sources while in progress. For example: the value of Physical constants, their symbols and right names, conversion factors...



...and the very useful Integral and Derivative tables.

✱Specifications subject to change without previous notice, due to the convenience of improvements of the product.

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REPRESENTATIVE:

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