



## INTRODUCTION

Current energy requirements need to transform techniques from effective to efficient in the generation, transport and consumption of energy. These needs have promoted new developments in the energy field, among them the energy storage systems.

Progress in materials engineering suggest the possibility of a storage based on the elastic deformation of springs. For that purpose, the methodology of this type of systems must be studied in depth, as well as the possible ways to optimize its characteristics.

A spring is a device able to experience reversible elastic deformations, allowing the storage of energy by external forces and releasing that energy when removing the forces that generate that strain. This type of elements can be made of different materials, such as metal alloys or plastics, enabling their use in a wide range of industrial, mechanical and even domestic applications.

In general, they are used in situations where a force is applied to return as energy, so they are designed to offer resistance or dampen the external forces.

There are three types of springs depending on the forces or stresses they can withstand:

Tension springs. They withstand tension forces, as its name implies. They are characterized by a hook in each end.

Compression springs. They are designed to withstand compression forces. They can be cylindrical, conical, hourglass, etc.

Torsion springs. They are springs subjected to torsion forces (torques).

There is a type of spring that combines the previous features since as they are tightened when wound up around an axis (as a torsion spring), they actually work under bending forces (as tension and compression springs).

The Vibration of Coil Spring Unit, "MVRE", is a teaching unit designed by EDIBON to study the characteristic parameters of a spring, specifically torsion in helical springs.

The unit is supplied with the material required to study a coil spring or the mass-spring system forming a torsion pendulum in different configurations, allowing the modification of relevant variables of the system, such as the torque applied, the total moment of inertia, the amplitude of the harmonic motion and its frequency.



ISO 9001: Quality Management (for Design, Manufacturing, Commercialization and After-sales service)



European Union Certificate (total safety)



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



"Worlddidac Quality Charter" and Platinum Member of Worlddidac

## GENERAL DESCRIPTION

The Vibration of Coil Spring Unit, "MVRE", unit has been designed to study and understand a coil torsion spring, a mass-spring system and the fundamental properties of its characteristic periodic motion.

In this sense, the unit consists of a rigid plate equipped with anchorage points where a rotating horizontal shaft is supported. A graduated disc to read the rotated angle; a lever joined to the shaft, where masses are located at different distance, and a coil torsion spring, attached to the shaft by one end and to the rigid plate by the other end, are arranged on the shaft.

Displacing the system a specific angle, the spring will exert a recovery force (torque) proportional to the stiffness of the spring due to the elastic deformation experienced. This parameter is one of the characteristic aspects of the spring and is known as spring constant "k".

On the other hand, locating the weights symmetrically in the arms of the lever a mass-spring system is generated. When that system is displaced a certain angle from its equilibrium position, it will describe a periodic motion characterized by its vibration frequency. Thus, it is possible to analyze the influence of the masses and their positions on the normal frequency of the resulting simple harmonic motion.

Besides, the unit can be directly fixed to the wall if desired.

## SPECIFICATIONS

Bench-top unit with adjustable legs.

Anodized aluminum structure and panels in painted steel.

The "MVRE" unit mainly consists of:

### Coil spring:

Material: hardened steel.

Section: 8 x 0.5 mm.

Øint: 18 mm.

Øext: 57 mm.

### Lever with movable weights for the coil spring deflection:

Material: stainless steel.

Adjustable distance from the center of gravity of the weight to the rotation axis: 42 – 150 mm.

Two movable weights made of stainless steel of 0.5 Kg.

### Goniometer to read the deflection angle:

Range: 0 – 360 °.

Resolution: 1 °.

### Chronometer to measure the vibration period.

Manuals: This unit is supplied with the following manuals: Required Services, Assembly and Installation, Starting-up, Safety, Maintenance & Practices Manuals.



MVRE detail

## EXERCISES AND PRACTICAL POSSIBILITIES

- 1.- Determination of the spring constant "k" of a coil torsion spring by Hooke's law (static method).
- 2.- Experimental determination of the natural frequency of vibration of a spring-mass system.
- 3.- Determination of the spring constant "k" of a coil torsion spring by the dynamic method.
- 4.- Influence of the mass distribution on the natural frequency of vibration of a spring-mass system.

## DIMENSIONS AND WEIGHTS

MVRE:

-Dimensions: 500 x 400 x 800 mm approx. (19.68 x 15.75 x 31.50 inches approx.)

-Weight: 12 Kg approx. (26.4 pounds approx.)

**MVRE/ICAI. Interactive Computer Aided Instruction Software System:**



With no physical connection between unit and computer, this complete software package consists of an Instructor Software (EDIBON Classroom Manager -ECM-SOF) totally integrated with the Student Software (EDIBON Student Labsoft -ESL-SOF). Both are interconnected so that the teacher knows at any moment what is the theoretical and practical knowledge of the students.

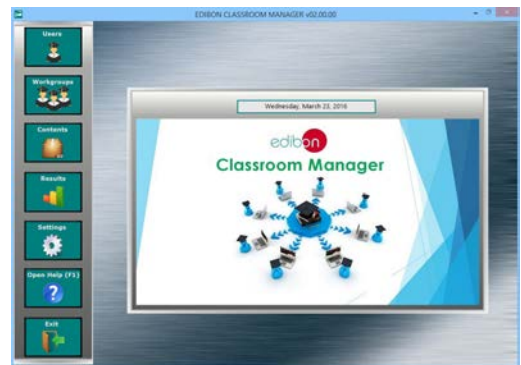
Instructor Software

- ECM-SOF. EDIBON Classroom Manager (Instructor Software).

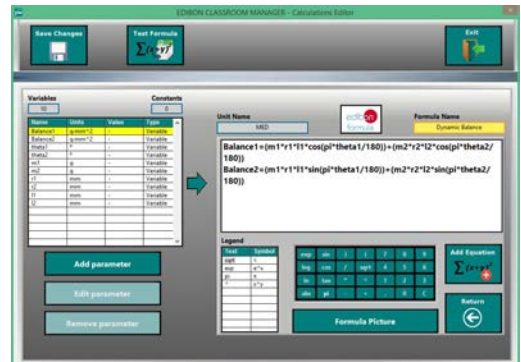
ECM-SOF is the application that allows the Instructor to register students, manage and assign tasks for workgroups, create own content to carry out Practical Exercises, choose one of the evaluation methods to check the Student knowledge and monitor the progression related to the planned tasks for individual students, workgroups, units, etc... so the teacher can know in real time the level of understanding of any student in the classroom.

Innovative features:

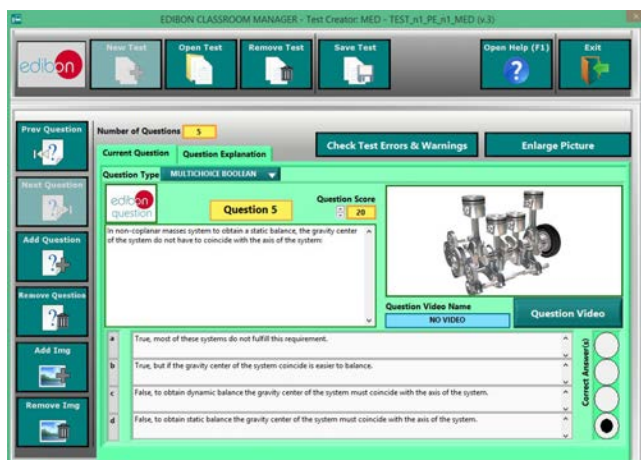
- User Data Base Management.
- Administration and assignment of Workgroup, Task and Training sessions.
- Creation and Integration of Practical Exercises and Multimedia Resources.
- Custom Design of Evaluation Methods.
- Creation and assignment of Formulas & Equations.
- Equation System Solver Engine.
- Updatable Contents.
- Report generation, User Progression Monitoring and Statistics.



ECM-SOF. EDIBON Classroom Manager (Instructor Software) Application Main Screen



ECAL. EDIBON Calculations Program Package - Formula Editor Screen



ETTE. EDIBON Training Test & Exam Program Package - Main Screen with Numeric Result Question



ERS. EDIBON Results & Statistics Program Package - Student Scores Histogram

Optional  
Student Software

- **ESL-SOF. EDIBON Student Labsoft (Student Software).**

ESL-SOF is the application addressed to the Students that helps them to understand theoretical concepts by means of practical exercises and to prove their knowledge and progression by performing tests and calculations in addition to Multimedia Resources. Default planned tasks and an Open workgroup are provided by EDIBON to allow the students start working from the first session. Reports and statistics are available to know their progression at any time, as well as explanations for every exercise to reinforce the theoretically acquired technical knowledge.

Innovative features:

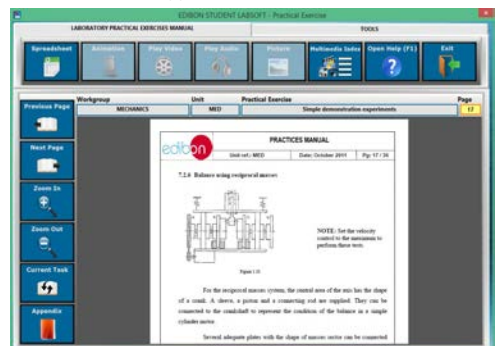
- Student Log-In & Self-Registration.
- Existing Tasks checking & Monitoring.
- Default contents & scheduled tasks available to be used from the first session.
- Practical Exercises accomplishment by following the Manual provided by EDIBON.
- Evaluation Methods to prove your knowledge and progression.
- Test self-correction.
- Calculations computing and plotting.
- Equation System Solver Engine.
- User Monitoring Learning & Printable Reports.
- Multimedia-Supported auxiliary resources.

For more information see ICAI catalogue. Click on the following link:

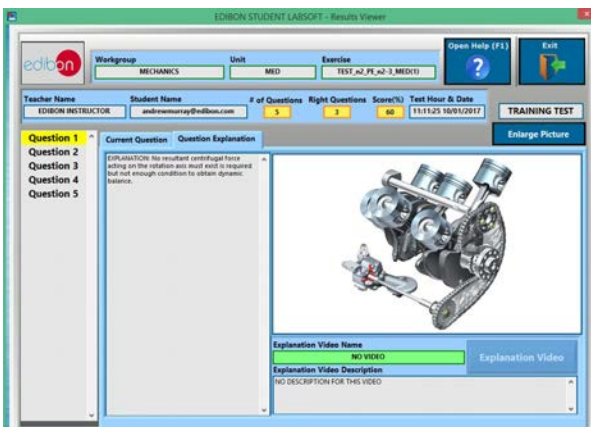
[www.edibon.com/en/files/expansion/ICAI/catalog](http://www.edibon.com/en/files/expansion/ICAI/catalog)



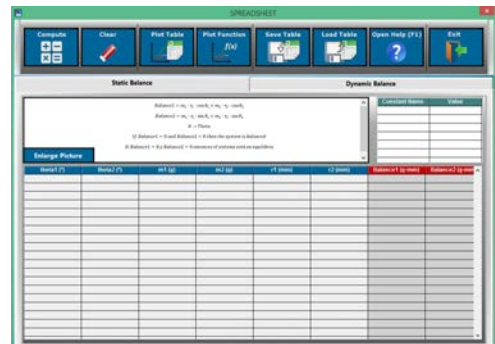
ESL-SOF. EDIBON Student LabSoft (Student Software)  
Application Main Screen



EPE. EDIBON Practical Exercise Program Package Main Screen



ERS. EDIBON Results & Statistics Program Package - Question Explanation



ECAL. EDIBON Calculations Program Package Main Screen

**BDAS. Basic Data Acquisition System and Sensors:**

For being used with mechanical modules.

BDAS is designed to monitor the measurements of each mechanical module from a computer.

\* Specifications subject to change without previous notice, due to the convenience of improvement of the product.



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REPRESENTATIVE:

