Unit for Studying Forces in a Simple Bar Structure

MFBS

INTRODUCTION

One of the most common structures in civil engineering is trusses, since they provide a practical and economical solution for the design and construction of bridges and buildings.

The main advantage of a truss when compared to other solutions is that, with a suitable design, a solid, resistant and light element is obtained. Choosing this type of structure is determined by the economic aspect, due to the fact that the savings related to material compensate for the higher building costs in the construction of openings that generally exceed a width of 15 m.

A truss consists of straight bars, located at a determined position in the space and joined at their ends by joints or nodes to form a rigid frame. Each truss is designed to support loads acting on its plane and, as a consequence, they can be considered a two-dimension structure. Loads supporting this type of structures must be applied in the joints, for that reason a truss is an element subjected to direct axial forces, that is to say, subjected to tension and compression.

In general, the basic unit of a truss is the triangular arrangement.

GENERAL DESCRIPTION

The Unit for Studying Forces in a Simple Bar Structure, "MFBS", designed by EDIBON allows the study of forces acting on a simple truss when is subjected to a point load in one of the nodes that make up the structure.

It consists of a group of five bars, three of them have the same length, and the other two are of different length.

Each bar has two sheets connected to one another by two supports and a dial gauge coupled to the bar by a support. These sheets can bend in function of the force applied to the bars, either tension or compression, thus being able to calculate that force by measuring the deformation generated in the sheet with the dial gauge.

The bars are joined by three node discs. Two of them, located at the bottom, are used as support for the structure and the third one is used to hang a certain load with the set of masses.

With the node discs, the arrangement of the bars can be changed to form different trusses, combining the junction angles between discs and bars. This way, angles of 60°/60°/60°, 45°/90°/45°, 30°/120°/30° and 120°/30°/30° between bars can be obtained.

The set of weights and a weight holder are used to apply external load in the upper disc of the simple bar structure.

The method of joints and the calculations are used to determine the bar forces in the different bar structure to compare with the experimental results.

SPECIFICATIONS

Bench-top unit with adjustable legs.

Anodized aluminum frame and panels made of painted steel.

The "MFBS" unit mainly consists of:

    Bars made of stainless steel:

        Three bars of 385 mm long, diameter: 8 mm.

        Bar of 575 mm long, diameter: 8 mm.

        Bar of 720 mm long, diameter: 8 mm.

    Each bar has a force meter attached to it that consists of:

        Set of flat bars made of aluminum, dimensions: 90 x 25 x 1 mm.

        Four nuts to adjust the length of the bars.

        Dial gauge, measuring range: 0 – 10 mm, graduations: 0.01 mm.

    Three node discs, diameter: 95 mm, with different positions to vary the angle between bars.

        Two of them support the bars of the structure and this structure to the base of the unit (one is a fixed support and the other is a movable support).

        The other (upper node disc) supports the bars of the structure and is used to hang different masses.

    Set of masses consisting of:

        Mass of 500 g (5 N).

        Mass of 1 Kg (10 N).

        Two masses of 2 Kg (20 N).

        Hook to hang the masses.

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

MFBS detail

EXERCISES AND PRACTICAL POSSIBILITIES

1.- Measurement of efforts on the bars of a simple bar structure.

2.- Measurement of efforts on the bars, in different configurations of a simple bar structure.

3.- Theoretical calculation of efforts in the bars, in different configurations of a simple bar structure, using the method of joints.

4.- Theoretical calculation of efforts in the bars, in different configurations of a simple bar structure, using the graphical method.

5.- Comparison of the experimental method with the theoretical methods: method of joints and graphical method.

DIMENSIONS AND WEIGHTS

MFBS:

  -Dimensions: 1000 x 300 x 500 mm approx. (39.37 x 11.81 x 19.68 inches approx.)

  -Weight: 15 Kg approx. (33 pounds approx)

MFBS/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.
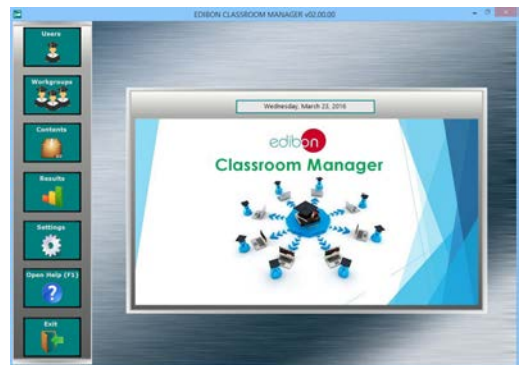
Instructor Software

**- 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
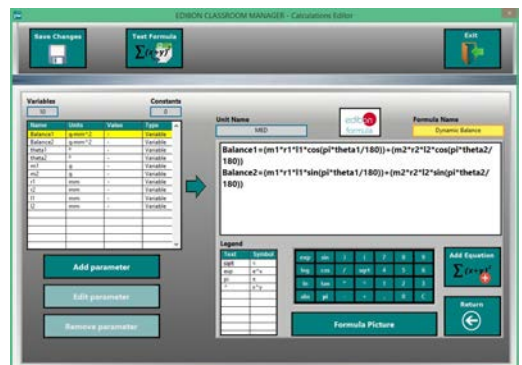
ECAL. EDIBON Calculations Program Package - Formula Editor
Screen
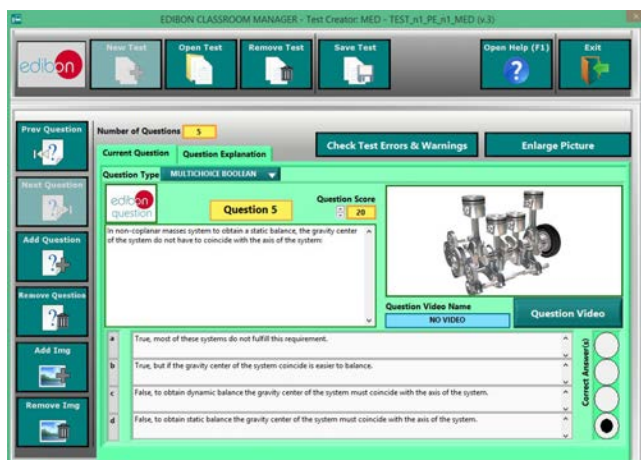
ETTE. EDIBON Training Test & Exam Program Package - Main Screen with
Numeric Result Question

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

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.
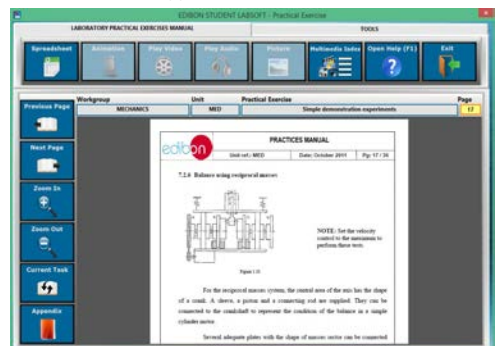
Innovative features:

• **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.**

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

EPE. EDIBON Practical Exercise Program Package Main Screen

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

www.edibon.com/en/files/expansion/ICAI/catalog
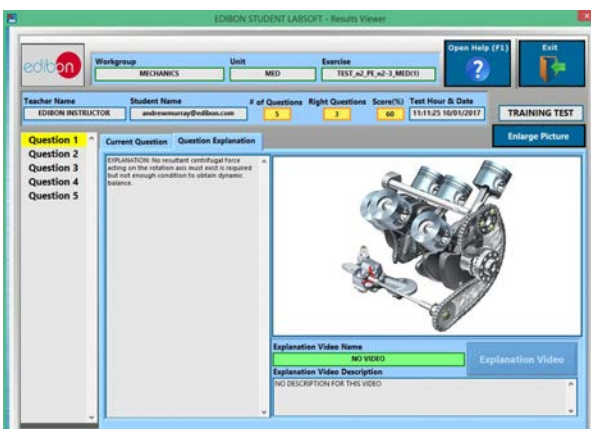
ERS. EDIBON Results & Statistics Program Package - Question Explanation
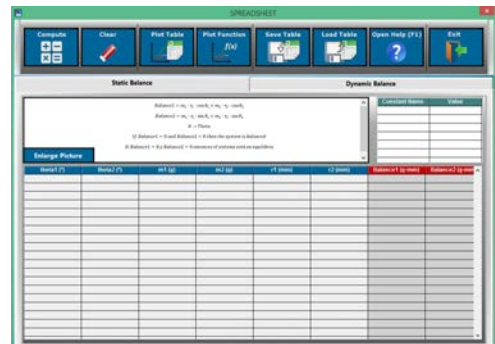
ECAL. EDIBON Calculations Program Package Main Screen

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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