# *ANNEX II + III:* TECHNICAL SPECIFICATIONS + TECHNICAL OFFER

**Contract title: Supply of training equipment, multimedia and kits for MEPEP - Multi-Educational Programme for Employment Promotion in Migration-Affected Areas – LOT 1, LOT 2, LOT 3, LOT 4, LOT 5 p 1 /…**

**Publication reference:** T05-EUTF-NOA-EG-01-06 (T05.255) - SUP04.2021  
**CIG**: Z2F3243F93

**Columns 1-2 should be completed by the contracting authority**

**Columns 3-4 should be completed by the tenderer**

**Column 5 is reserved for the evaluation committee**

Annex III - the contractor's technical offer

The tenderers are requested to complete the template on the next pages:

* Column 2 is completed by the contracting authority shows the required specifications (not to be modified by the tenderer),
* Column 3 is to be filled in by the tenderer and must detail what is offered (for example the words ‘compliant’ or ‘yes’ are not sufficient),
* Column 4 allows the tenderer to make comments on its proposed supply and to make eventual references to the documentation.

The eventual documentation supplied should clearly indicate (highlight, mark) the models offered and the options included, if any, so that the evaluators can see the exact configuration. Offers that do not permit to precisely identify the models and the specifications may be rejected by the evaluation committee.

The offer must be clear enough to allow the evaluators to make an easy comparison between the requested specifications and the offeredspecifications.

All equipment/machineries and parts listed shall be used for training/educational purpose.

It should be avoided to copy the specifications required from Column 2 to specifications offered in Column 3. Column 3 shall be filled by the Tenderer with the exact/real specification of the offered goods (not the range or the min. max. threshold provided in the specifications). For instance, if the required specification is “length between 100 and 120cm”, the specification offered shall be i.e., “110cm or 110cm ±2”.

Unless otherwise specified, the requirements in these Technical Specifications are presented as a minimum standard, which the offered goods must meet.

Whenever a specific brand is used in the technical specification for which a sufficiently precise and fully intelligible description is not possible, it means that the specifications shall meet the brand or its equivalent in terms of functionality.

Each offered goods must be stated with brand/product name, product version and product/part number. The tenderer shall identify model and manufacturer of each item in their technical offer. The proposed models of a brand must be currently available by the manufacturer as an accessible product and Contracting Authority may further request clarifications for identification of the brand/models proposed by tenderers.

GENERAL REQUIREMENTS

*1. General Technical Requirements*

1.1. All equipment, machinery, and deliverables must be provided with the necessary accessories and/or parts to ensure that the unit is capable of operating to the required technical and quality specifications immediately. Any improvements on the specifications or additional features offered should be clearly identified in the Tenderer´s offer.

1.2. All supplies under the same lot must be fully functional “as a whole”. Any interoperability problems between software and hardware must be resolved by the Contractor at no additional cost to the Contracting Authority.

1.3. No devices and equipment offered can be prototypes.

1.4. The type of supplied voltage in Egypt is 220 V (monophase) and 380 V (triphase + neutral). The quality and stability of the supplied current may undergo fluctuations (+ and -) of more than 10%. All hardware must operate on 220 V +- 20 V, 50 Hz +-0.5 Hz, or 380 V +- 40 V, power supply and be suitable for direct connection to the standard power outlets in Egypt. The type of electrical outlets generally installed in Egypt is the type with 2 side mounted earthing poles (EUROPLUG). All plugs of all goods will have to fit exactly. The contractor shall evaluate the supplied current, the quality of the current and the fluctuations of the current and take the necessary precautions to avoid damages to the equipment.

1.5. The supplies must be compliant with EU regulations (which shall be proved with relevant certifications to the regulations, such as CE norm, energy efficiency, and environmental management certifications etc.), relevant EU, and international standards. Tenderers shall state in their offers the standards/regulations valid for the offered items. Wherever reference is made in the Technical Specifications to specific standards and codes to be met by the goods and materials to be furnished or tested, the provisions of the latest current edition or revision of the relevant standards in effect, shall apply, unless otherwise stated in this technical specification.

1.6. The Contractor will be responsible for providing measures for any Health & Safety risks associated with equipment provided and that equipment shall also comply with occupational health and safety standards. Evaluation Committee may further request additional information/confirmation for the standards.

*2. Technical Documents to be provided during the implementation period*

2.1. All supplies must be supplied with appropriate documentation (i.e. original set of operating and users’ manuals developed by the vendor, instructions for routine use and maintenance procedure) in English (Arabic and Italian version are also recommended). Manuals must be provided in hard copy and in electronic copy.

*3. Installation and Commissioning Requirements*

3.1. The goods must be delivered with all materials and any other auxiliary equipment or tools essential for immediate and complete operation.

3.2. Full assembly and complementary services related to the installation and put into operation will be borne by the Contractor. Connection to main electrical, mechanical, air, water, gas supplies etc. shall be done by Contractor according to the national rules. The cost of connection materials (fittings, cabling etc.) shall be included to price of goods. The Contractor will provide the inputs necessary for smooth operation of the equipment and proper fittings and connections for the equipment.

3.4. Contractor shall make available to himself all tools, materials and equipment required for in-house transport, assembling and installation as mentioned under Article 15 of General Conditions.

3.5. Contractor shall perform starting-up of the equipment, furnishing of all required materials such as consumables needed for testing, training, validation, commissioning, and initial operation of goods supplied.

*4. Materials to be provided for Training, Validation and Acceptance Tests*

4.1. The Contractor is fully responsible for the validation of process of the equipment. All functions described in TS documents shall be tested before training. Contractor shall be responsible for installation all items as referred in their installation guides that supplied from manufacturer.

4.2. The contractor shall provide necessary materials and consumables for the successful completion of equipment trainings.

4.3. All materials supplied shall be original consumables for offered equipment.

4.4 Consumables shall be furnished at least for 5 years of normal training activity according to the experience of the Contractor.

*5. Training Requirements*

5.1. The contractor shall provide necessary training to the personnel to be designated by the beneficiary following delivery of the supplies and all equipment according to table provided below which indicates the minimum durations:

| **Lot number** | **Scope of the training** | **Duration of the training** |
| --- | --- | --- |
| LOT 1 | Orientation training including theoretical and practical issues and comprehensive practice concerning any supplied units within the Lot | 6 days |
| LOT 2 | Orientation training including theoretical and practical issues and comprehensive practice concerning any supplied units within the Lot | 10 days |
| LOT 3 | Orientation training including theoretical and practical issues and comprehensive practice concerning any supplied units within the Lot | 6 days |
| LOT 4 | Orientation training including theoretical and practical issues and comprehensive practice concerning any supplied units within the Lot | 5 days |
| LOT 5 | Orientation training including theoretical and practical issues and comprehensive practice concerning any supplied units within the Lot | 4 days |

5.2. The Tenderer will include in his/her offer a training plan including content, participant, and number of days (days/hours provided under Article 5.1 are requested as minimum). If required, these specified training durations can be extended by the Contractor (if needed) and topics to be covered for the items will be proposed. The Contractor is latter expected to propose a final training plan with exact number of days and participants and training methodology after the commencement the Contract.

5.3. Training will start immediately after the equipment’s delivery.

5.4 Training will be carried out by an expert or experts experienced in similar training.

5.5. All training costs shall be covered by the Contractor. The Contractor will provide all necessary accessories and materials (including consumables) for the performance of trainings.

5.6. Trainings will be carried out at the delivery place of the supplies and the Contractor shall provide sufficient training materials. The language used during the training must be Arabic. The language of the training documents will be in English.

5.7. Starting date and time-table of the training courses shall be in accordance with the programme of implementation of tasks submitted by the Contractor and approved by the Contracting Authority.

*6. Test, Maintenance and After Sale Service Requirements*

6.1. The items offered shall have an operational service center in Egypt.

**LOT 1: TRAINING EQUIPMENT FOR ELECTRICAL AND ELECTRONICS LABS**

| **1.**  **Item number** | **2.**  **Specifications required** | **3.**  **Specifications offered** | **4.**  **Notes, remarks,  ref to documentation** | **5.**  **Evaluation committee’s notes** |
| --- | --- | --- | --- | --- |
| **1.1** | **WORKBENCH FOR CIVIL/INDUSTRIAL ELECTRICAL PRACTICAL TRAINING EXPERIENCES** |  |  |  |
|  | Quantity: 8 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.1.1 | Four student stations with independent power supply and a framework for fast mounting panels and/or grids to conduct experiences |  |  |  |
| 1.1.2 | Power supply shall be protected according to EU regulations and provide availability of the following outputs for each student:   * a 3-phase + N + PE, 16A on 36A safety terminals; protection must be through differential, magneto-thermal, 4-pole, 16A automatic switch, signalling lamp and switch with key for control by the teacher/trainer * two 10/16A single-phase mains sockets, the protection must be by means of a differential, magneto-thermal, 16A automatic switch and signalling lamp * a 0 ÷ 12 ÷ 24Vac, min. 4A on isolated terminals, the protection must be by means of a magneto-thermal, automatic switch * optical and acoustic circuit testers on isolated terminals, the protection must be by means of fuses |  |  |  |
| 1.1.3 | Dimension: min. 180 x 60 x 160 cm and height from ground to work surface: 80 ÷ 100 cm |  |  |  |
| 1.1.4 | Worktop made of bi-laminated wood and sturdy legs provided with compensation feet |  |  |  |
| 1.1.5 | User manual must be in English language |  |  |  |
| **1.2** | **ELECTRICAL COUPLING SYSTEM** |  |  |  |
|  | Quantity: 32 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.2.1 | Electrical coupling system to keep the students safe when they connect the wired circuit on the panel/grid of the bench with the safety terminals of the power supply operating at mains voltage |  |  |  |
| 1.2.2 | Provided with safety leads for connection to the mains |  |  |  |
| **1.3** | **GRID FRAME PANEL** |  |  |  |
|  | Quantity: 32 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.3.1 | Panel suitable for industrial electrical application with holes and/or slot and/or recess for easy and fast assembly of the components and easy and fast installation on the workbench framework, item 1.1 |  |  |  |
| 1.3.2 | Material: metal or aluminium  Metal panel must be properly treated to be rust proof and zinc-coated |  |  |  |
| 1.3.3 | Dimensions: min 80 x 80 cm |  |  |  |
| **1.4** | **STRIP PANEL** |  |  |  |
|  | Quantity: 32 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.4.1 | Moveable strip panel suitable for industrial electrical application with holes and/or slot and/or recess for easy and fast assembly of the components and easy and fast installation on the workbench framework, item 1.1 |  |  |  |
| 1.4.2 | Material: metal or aluminium  Metal panel must be properly treated to be rust proof and zinc-coated |  |  |  |
| 1.4.3 | Dimensions: min 80 x 80 cm |  |  |  |
| **1.5** | **JUNCTION BOXES PANEL** |  |  |  |
|  | Quantity: 32 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.5.1 | Panel with interconnected junction boxes to simulate a wall suitable for civil electrical application with holes and/or slot and/or recess for easy and fast installation on the workbench framework, item 1.1 or on items 1.3 or 1.4 |  |  |  |
| 1.5.2 | Number of junction boxes: min 6.  Each junction box must be suitable for switches, buzzers, sockets, etc. to simulate a civil installation, with the possibility to connect external units, such as lamp holders, intercom, door entry systems, etc. |  |  |  |
| 1.5.3 | Material recommended: wood |  |  |  |
| 1.5.4 | Dimensions: min 60 x 30 cm |  |  |  |
| **1.6** | **KIT FOR CIVIL ELECTRICAL TRAINING EXPERIENCES** |  |  |  |
|  | Quantity: 16 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.6.1 | Kit of components including manuals for realising several training experiences regarding civil electrical installations.  Number of experiences that can be realised: min 20 |  |  |  |
| 1.6.2 | List of practical civil electrical experiences to be performed (not limited to):  - single-point lighting installation  - single-point lighting installation with a socket  - two-lamps lighting installation with a switch  - three-point lighting installation  - four-point lighting installation  - lighting installation with circuit breaking relay  - lighting installation with switching relay  - lighting installation with time relay  - hot cathode fluorescent lamp installation  - signalling installations  - single-control signalling installation  - reciprocal control signalling installation  - signalling installation with display indicator and reset pushbutton  - ringing installation with control of door and main entrance  - electric lock bell installation  - two short distance reciprocal call house phones  - two long distance reciprocal call house phones  - two coupled house phones  - main house phone and two shunted house phones installation  - intercommunicating house phone installation |  |  |  |
| 1.6.3 | List of components (not limited to):  3 pushbuttons  3 bell pushbuttons  3 pushbuttons for opening the door  3 switches  2 change-over switches  2 reversing switches  1 mains socket  3 bells  1 buzzer  2 fuses with fuse holders  1 time relay for the light of the stairs  1 pulse relay  2 incandescent lamps with holders  1 fluorescent lamp with holder  1 starter and choke  1 electric lock  1 panel with 3 pushbuttons  1 panel with 4 displays  3 entry-phones with buzzer and 3 pushbuttons  1 power supply for the entry-phone  1 transformer  DIN section  set of screws  box(es) for storage of the components |  |  |  |
| 1.6.4 | User manual(s) must be in English language and cover theoretical and practical diagrams of the main circuits that are used in civil installations and in addition to theory and electric diagrams to allow performing the whole set of experiences of the kit |  |  |  |
| **1.7** | **KIT FOR INDUSTRIAL ELECTRICAL TRAINING EXPERIENCES** |  |  |  |
|  | Quantity: 16 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.7.1 | Kit of components including manuals for realising several training experiences regarding industrial electrical installations.  Number of experiences that can be realised: min 24 |  |  |  |
| 1.7.2 | List of practical industrial electrical experiences to be performed (not limited to):  - Operator interface  - Logic operators (OR, AND, NOT, OR exclusive)  - Contactors (self‐holding, interlocking, sequential control)  - Thermal relay  - Manual star/delta starting and reversing  - On and off delay time relays  - Sequential control  - Solid state relay  - Pulse generator  - Automatic star/delta starting  - Manual and automatic starting with rotor resistance  - Star/delta starting with reversing circuit and plugging braking  - Pole changing circuit and pole changing reversing circuit, Dahlander connection  - Reversing circuit time relay |  |  |  |
| 1.7.3 | List of components (not limited to):  1 transformer mains/2x12V  1 emergency pushbutton (NO+NC contact)  3 lamp holders (red, yellow and green) with 24V lamp  3 pushbuttons (red, yellow and green) with NO+NC contact  2 multifunction on‐off delay time relay  5 contactors with 2 NO+NC contacts  1 thermal relay with support  1 fuse holder with fuses  1 couple of lamp holders  3 DIN sections  1 set of screws  1 3-PH induction motor (with slip ring rotor, manual braking device, three-step starting rheostat and it must be supplied with a hooked module with safety terminals for electric connection, supplied with a switch to select different loads and a nominal power: min. 350W, voltage: 380V, 50Hz.)  1 Dahlander motor (a 3-ph squirrel cage pole changing induction motor, performance B3 bench type, possibility to perform experiences about speed control, pole-changing motor with delta-series connection and start-parallel connection, supplied with a hooked module with safety terminals for electric connection, and a rated power of min 350W)  box(es) for storage of the components |  |  |  |
| 1.7.4 | User manual(s) must be in English language and cover theoretical and practical diagrams of the main circuits that are used in industrial installations and in addition to theory and electric diagrams to allow performing the whole set of experiences of the kit |  |  |  |
| **1.8** | **ELECTRICIANS TOOLKIT** |  |  |  |
|  | Quantity: 32 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.8.1 | Kit of tools for electricians  It must include wrenches, screwdrivers, electrician scissors, and all the tools required to perform properly the whole set of experiences included in item 1.6 and 1.7 |  |  |  |
| **1.9** | **LOCKER** |  |  |  |
|  | Quantity: to be specified by the tenderer |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.9.1 | Container for panels/grids with key lock doors, suitable for housing panels with unfinished wiring.  Including locking systems and keys.  Number of lockers must be sufficient to store items 1.3, 1.4, and 1.5 |  |  |  |
| **1.10** | **WIRING AND TERMINALS SET** |  |  |  |
|  | Quantity: to be specified by the tenderer |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.10.1 | This set should include cables, various types of terminals and essential accessories for all trainer kits for both civil and industrial installations |  |  |  |
| **1.11** | **TRAINER BASE UNIT FOR VOCATIONAL ELECTRONICS STUDIES** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.11.1 | The trainer base unit must have:   * an USB interface for connection with PC * at least DC outputs: 0/+15 Vdc, 0/-15 Vdc, +15 Vdc, -15 Vdc, +5 Vdc, -5 Vdc, 1A * AC outputs: 6 ÷ 0 ÷ 6 Vac, 1A * interface for connecting experimental/training boards/modules * minimum 12 relays interfaced on the BUS output managed by software, 6 NO and 6 NO/NC relays * protection against over voltage and short circuit * robust structure and moder design   Supplied with cables, accessories, and software for putting it into operation |  |  |  |
| 1.11.2 | User manual must be in English language |  |  |  |
| **1.12** | **BOARD/MODULE FOR THE STUDY OF DC FUNDAMENTALS** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.12.1 | The trainer base unit must have:   * an USB interface for connection with PC * at least DC outputs: 0/+15 Vdc, 0/-15 Vdc, +15 Vdc, -15 Vdc, +5 Vdc, -5 Vdc, 1A * AC outputs: 6 ÷ 0 ÷ 6 Vac, 1A * interface for connecting experimental/training modular boards * minimum 12 relays interfaced on the BUS output managed by software, 6 NO and 6 NO/NC relays * protection against over voltage and short circuit * robust structure and moder design   Supplied with cables, accessories, and software for putting it into operation |  |  |  |
| 1.12.2 | User manual must be in English language |  |  |  |
| **1.13** | **BOARD/MODULE FOR THE STUDY OF DC FUNDAMENTALS** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.13.1 | The board/module must allow the students to train about the principles of the basic electronics including:   * use of batteries * study of the circuits in series and in parallel * the effect of the power’s transfer to a load * the use of the basic instrumentation as Voltmeter and Ammeter and Ohmmeter   It must be possible to study theory and to perform experiments.  It must allow the insertion of simulated faults by software and by microswitches integrated. |  |  |  |
| 1.13.2 | The board/module shall include the following subjects (not limited to):  - DC power sources  - types of switches and switching  - Ohm’s law  - series/parallel resistive circuits  - power in DC circuits  - circuits with linear and non-linear resistance  - Voltage/Current divider  - DC meters |  |  |  |
| 1.13.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - batteries  - switches  - Ohm’s law  - series circuit  - parallel circuit  - series/parallel circuit  - power  - linear/non-linear variable resistor  - volage divider  - voltmeter/ammeter/ohmmeter |  |  |  |
| 1.13.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.13.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.14** | **BOARD/MODULE FOR THE STUDY OF DC CIRCUITS** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.14.1 | The board/module must allow the students to learn about operation of DC circuits, including series and parallel generation, the Ohm’s law, the resistors, and their behaviour.  It must be possible to study theory and to perform experiments.  It must allow the insertion of simulated faults by software and by microswitches integrated |  |  |  |
| 1.14.2 | The board/module shall include the following subjects (not limited to):  - circuits structure  - electric current  - voltage and e.m.f.  - electric resistance  - conventional direction of voltage and current  - types of measurement and of errors  - measurement of e.m.f., voltage, current, and resistance  - Ohm’s law  - conductors’ resistivity and temperature coefficient  - circuit with linear and non-linear resistance  - types of resistors, resistors’ value, series, and parallel resistors  - constant and variable signals  - Wheatstone bridge  - fault simulation |  |  |  |
| 1.14.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - batteries  - switches  - Ohm’s law  - series circuit  - parallel circuit  - series/parallel circuit  - power  - linear/non-linear variable resistor  - volage divider  - voltmeter/ammeter/ohmmeter |  |  |  |
| 1.14.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.14.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.15** | **BOARD/MODULE FOR THE STUDY OF ELECTRIC FIELD** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.15.1 | The board/module must allow the students to learn about the characteristics of an electric field, including the different types of series and parallel capacitors, and the principles of capacitor charging and discharging.  It must be possible to study theory and to perform experiments.  It must allow the insertion of simulated faults by software and by microswitches integrated |  |  |  |
| 1.15.2 | The board/module shall include the following subjects (not limited to):  - fields of force  - field vector  - potential and potential difference  - characteristics of the electric field  - measurement units  - electric field generated by a uniformly loaded unlimited plane surface  - electric field of a double plane surface  - capacitors: identification, charge and discharge, energy of the electric field in the capacitors |  |  |  |
| 1.15.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - superficial electrification of the bodies  - electrostatic machine  - type and energy of the capacitors  - series and parallel capacitors  - charge and discharge of a capacitor |  |  |  |
| 1.15.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.15.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.16** | **BOARD/MODULE FOR THE STUDY OF MAGNETIC CIRCUITS** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.16.1 | The board/module must allow the students to learn about the characteristics of a magnetic field that is generated by 3 different types of conductors (rectangular, circular, and solenoid), the operation of a magnetic switch and of an electromagnet with the hysteresis loop and the principle of nonlinear resistances.  It must be possible to study theory and to perform experiments.  It must allow the insertion of simulated faults by software and by microswitches integrated |  |  |  |
| 1.16.2 | The board/module shall include the following subjects (not limited to):  - magnetic field characteristics  - diamagnetic, paramagnetic, and ferromagnetic materials  - soft and rigid ferromagnets, hysteresis cycle, magnetic quantities, and measurement units  - Hall’s effect and potential difference  - Hopkinson’s law  - magnetic field energy  - VDR |  |  |  |
| 1.16.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - magnetic field created by a rectilinear, a circular conductor, and a solenoid conductor  - magnetic induction measurement  - magnetic switch  - electromagnet  - hysteresis cycle  - VDR |  |  |  |
| 1.16.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.16.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.17** | **BOARD/MODULE FOR THE STUDY OF ELECTROMAGNETISM** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.17.1 | The board/module must allow the students to learn about the principles of electromagnetic induction with its laws, the use of a moving coil and the principles of DC electric machines.  It must be possible to study theory and to perform experiments.  It must allow the insertion of simulated faults by software and by microswitches integrated |  |  |  |
| 1.17.2 | The board/module shall include the following subjects (not limited to):  - Lorentz’s force  - force in a wire run by current in a magnetic field  - induction  - Faraday-Neumann’s law  - Lenz’s law  - self-induction  - relays  - moving coil ammeter  - static transformer  - alternators and dynamos  - DC electric motors |  |  |  |
| 1.17.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - electrodynamic action  - magnetic field of a coil: the relay  - electromagnetic induction  - moving coil instrument  - transformer  - principle of the electric motor  - DC motor |  |  |  |
| 1.17.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.17.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.18** | **BOARD/MODULE FOR THE STUDY OF AC CIRCUITS** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.18.1 | The board/module must allow the students to learn about the operating principle of the AC circuits through inductors, resistors and capacitors and the function of filters and resonant circuits.  It must be possible to study theory and to perform experiments.  It must allow the insertion of simulated faults by software and by microswitches integrated |  |  |  |
| 1.18.2 | The board/module shall include the following subjects (not limited to):  - sinusoidal AC currents and voltages  - vector and symbolic representation of the sinusoidal electric quantities  - sum and difference of sinusoidal quantities  - product of a sinusoidal quantity by a constant, of two sinusoidal quantities and of a sinusoidal quantity by a complex number  - elementary bipoles (R, L, C)  - bipoles in series and parallel configuration (R-L, R-C, R-L-C)  - oscillating circuits and filters: frequency response of the AC circuits, low-pass, high-pass, and pass-band filter |  |  |  |
| 1.18.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - AC quantities  - resistive circuit  - capacitive circuit  - R-C circuit (series and parallel)  - inductive circuit  - R-L circuit (series and parallel)  - series resonant circuit  - parallel resonant circuit  - low-pass (R-C)  - high-pass (C-R)  - low-pass (L-R)  - high-pass (R-L)  - pass-band filter |  |  |  |
| 1.18.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.18.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.19** | **BOARD/MODULE FOR THE STUDY OF ELECTRONIC DEVICES** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.19.1 | The board/module must allow the students to learn about the properties of pure and doped semiconductor material, the properties, the electric behaviour and the realization of a P-N junction.  It must be possible to study theory and to perform experiments.  It must allow the insertion of simulated faults by software and by microswitches integrated |  |  |  |
| 1.19.2 | The board/module shall include the following subjects (not limited to):  - physics of the semiconductors and P-N junction  - semiconducting material  - formation and polarization of a P-N junction  - ideal and real diode  - diode in DC circuits  - use of an ohmmeter to check the diode integrity  - direct and inverse polarization  - Zener diode  - diode as stabilizer  - LED diode |  |  |  |
| 1.19.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - direct and inverse polarization of a diode  - voltage at the diode ends  - min and max voltages  - min and max voltages with series connected diodes  - Zener diode characteristics  - Zener diode as a voltage stabilizer  - voltage on a Zener diode  - LED diode characteristics  - 7-segment digital display |  |  |  |
| 1.19.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.19.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.20** | **BOARD/MODULE FOR THE STUDY OF ELECTRONIC DEVICES** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.20.1 | The board/module must allow the students to learn about various applications of the diodes, such as clipping and clamping circuits and rectifiers with filters to generate dual or stabilized continuous power supplies.  It must be possible to study theory and to perform experiments.  It must allow the insertion of simulated faults by software and by microswitches integrated |  |  |  |
| 1.20.2 | The board/module shall include the following subjects (not limited to):  - behaviour of the diode in circuits containing variable signal generators  - simple and double clipper circuits  - half-wave voltage doublers  - simple and double half-wave rectifier circuits  - bridge rectifier circuit  - power supplies  - filters  - regulators |  |  |  |
| 1.20.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - clipping circuit  - clamping circuit  - one half-wave voltage doubler  - simple and double half-wave rectifier  - diode bridge rectifier (Graetz bridge) with capacitive input filter  - dual and stabilized power supply |  |  |  |
| 1.20.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.20.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.21** | **BOARD/MODULE FOR THE STUDY OF TRANSISTORS** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.21.1 | The board/module must allow the students to learn about the characteristics of transistors, their polarization and their use as voltage regulators or switches.  It must be possible to study theory and to perform experiments.  It must allow the insertion of simulated faults by software and by microswitches integrated |  |  |  |
| 1.21.2 | The board/module shall include the following subjects (not limited to):  - transistor currents  - input and output characteristics  - collector feedback polarization  - voltage divider polarization  - emitter polarization  - transistor as a switch and as a regulator |  |  |  |
| 1.21.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - verification of the integrity of the junctions of a BJT transistor  - recording of the input and output characteristics of a BJT transistor in the common emitter and in the common base configuration  - base and emitter polarization of a BJT transistor  - polarization of a BJT transistor with voltage divider  - polarization of the collector feedback BJT transistor  - operation of a BJT transistor as a switch  - voltage regulator with parallel and series transistor |  |  |  |
| 1.21.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.21.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.22** | **BOARD/MODULE FOR THE STUDY OF AMPLIFICATION** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.22.1 | The board/module must allow the students to learn about different configurations of BJT transistors, with emitter, collector, and common base and the configurations as power amplifiers in class B and C.  It must be possible to study theory and to perform experiments.  It must allow the insertion of simulated faults by software and by microswitches integrated |  |  |  |
| 1.22.2 | The board/module shall include the following subjects (not limited to):  - current  - voltage and power linear amplification  - BJT amplifiers in EC, CC and BC configurations  - linear amplifier thermal stability  - static and dynamic load line  - Intermediate and final stage pre‐amplifiers  - class A, B and C power amplifiers |  |  |  |
| 1.22.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - common emitter amplifier  - common base amplifier  - common collector amplifier  - push‐pull power amplifier in class B  - power amplifier tuned in class C |  |  |  |
| 1.22.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.22.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.23** | **BOARD/MODULE FOR THE STUDY OF DIFFERENT TYPES OF AMPLIFIERS** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.23.1 | The board/module must allow the students to learn about different configurations of amplifiers by using the most common electronic devices.  It must be possible to study theory and to perform experiments.  It must allow the insertion of simulated faults by software and by microswitches integrated |  |  |  |
| 1.23.2 | The board/module shall include the following subjects (not limited to):  - phase inverter or buffer circuit  - Darlington configuration  - differential, operational amplifiers, inverting and non-inverting configuration  - voltage follower, offset voltage, slew-rate, I/V and V/I converters  - single supply operational amplifiers  - switching and power amplifiers  - switching operation  - PWM modulator  - converter or electronic switch  - DC-DC converter |  |  |  |
| 1.23.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - phase separator  - Darlington connection  - differential and operational amplifier: reduction of the offset voltage, inverting and non-inverting configuration and slew-rate, voltage follower, voltage-current and current-voltage converter  - single supply operational amplifier  - PWM modulator  - step-up and step-down DC-DC converter |  |  |  |
| 1.23.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.23.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.24** | **BOARD/MODULE FOR THE STUDY OF DIFFERENT TYPES OF AMPLIFIERS** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.24.1 | The board/module must allow the students to learn about all possible configurations of the operational amplifier 741 from the inverting to the ramp generator, its characteristics as CMRR and slew rate and the operation of the integrated NE555 used as stable and astable multivibrator.  It must allow the insertion of simulated faults by software and by microswitches integrated |  |  |  |
| 1.24.2 | The board/module shall include the following subjects (not limited to):  - ideal operational amplifier  - common mode and differential voltage  - negative feedback  - main operational amplifier linear configurations  - virtual mass  - inverting and non-inverting configuration  - inverting summing amplifier  - zero and different from zero level detector  - differential amplifier  - integrator, derivator  - 741 operational amplifier  - meaning of CMRR, Vos and slew rate  - comparators, ramp, and square wave generators  - comparator circuit  - transfer characteristics  - inverting Schmitt trigger  - square wave generator (astable multivibrator with operational amplifier)  - ramp generator  - 555 integrated circuit as astable and monostable multivibrator |  |  |  |
| 1.24.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - inverting and non-inverting operational amplifier  - operational amplifier parameters: CMRR, slew rate  - offset voltage reduction, differential and summing amplifier  - operational amplifier: integrator and shunt  - comparator: inverting, non-inverting and with hysteresis (Schmitt trigger)  - operational amplifier as astable multivibrator  - ramp generator  - timer 555 as astable and monostable multivibrator |  |  |  |
| 1.24.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.24.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.25** | **BOARD/MODULE FOR THE STUDY OF DIGITAL LOGIC FUNDAMENTALS - PART 1** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.25.1 | The board/module must allow the students to learn about basic principles of digital logic, theorems of Boolean algebra, logic functions, Karnaugh’s maps, NOT-AND-OR-NAND-NOR logic gates, flip-flops and TTL and CMOS logic families.  It must allow the insertion of simulated faults by software and by microswitches integrated |  |  |  |
| 1.25.2 | The board/module shall include the following subjects (not limited to):  - logic connectives and fundamental theorems of the Boolean algebra  - binary system  - logic functions  - algebraic description of the logic networks, truth tables  - minimization techniques of the logic functions  - logic gates  - NOT, AND, NAND, OR and NOR logic operators  - AND and OR operators as control devices in the transfer of logic signals  - definition of flip-flop, S - R flip-flop, S - R flip-flop with NOR operators, S - R flip-flop with NAND operators  - J - K and master-slave J - K flip-flop  - T flip-flop, D flip-flop  - logic families: TTL family, CMOS family  - logic gates characteristic parameters  - logic families interfacing  - TTL circuits outputs and types  - interfacing from CMOS to TTL and vice versa  - TTL with totem-pole outputs  - open-collector gates  - wired-and function Page  - types of TTL circuits  - Schottky and low power Schottky of advanced type (AS/ALS)  - interfacing with the bus  - example of transmitter/receiver for a bi-directional bus |  |  |  |
| 1.25.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - AND/NAND  - OR/NOR  - XOR/XNOR  - Open Collector  - SET/RESET Flip-Flop  - D-Type Flip-Flop  - JK Flip-Flop  - Tri-State Output  - TTL/CMOS Comparison  - Data Bus Control |  |  |  |
| 1.25.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.25.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.26** | **BOARD/MODULE FOR THE STUDY OF DIGITAL LOGIC FUNDAMENTALS - PART 2** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.26.1 | The board/module must allow the students to learn about the characteristics of a combinatory logic network by means of encoders and decoders, multiplexers and demultiplexers, D/A and A/D converters, parity controllers, BCD/DEC converters, counters, comparators, shift registers and adders.  It must allow the insertion of simulated faults by software and by microswitches integrated |  |  |  |
| 1.26.2 | The board/module shall include the following subjects (not limited to):  - definition and characteristics of a combinatory logic network, BCD code, DEC/BCD and BCD/DEC code converters  - encoders and decoders  - multiplexers and demultiplexers  - parity and parity logic circuits  - 9-bit 74180 parity generator/detector  - unipolar and bipolar codes  - A/D converters, staircase A/D converter, ADC converter of parallel or flash type, with simple and double slope, D/A converters (DAC), D/A converter with weighed resistances and with R-2R network  - 4 bit asynchronous and synchronous binary counter, asynchronous and synchronous decimal counter, up/down synchronous counters  - adders, half and full adders, parallel binary adders, 4-bit adder  - quantity and 4-bit comparators, shift registers, 4-bit bi-directional shift registers |  |  |  |
| 1.26.3 | To perform the experiments, the board/module must include at least the following experimental areas/circuits (not limited to):  - BCD Decimal Decoder/BCD Priority Encoder  - ADC/DAC  - multiplexer/demultiplexer  - 7-Segment Driver/Display  - parity Generator/Checker  -+5V regulated supply  - built-in clock circuit  - built-in pulse generator circuit  - built-in counter circuitry  - logic switches and logic probes |  |  |  |
| 1.26.4 | Software able to allow the study of theoretical and practical topics using PC and HTML navigation software |  |  |  |
| 1.26.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.27** | **OSCILLOSCOPE** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.27.1 | Bandwidth: 100 MHz  Analog Channels: 2  Trigger: external channel  Maximum sample rate: 2GSa/s  Waveform update rate: ≥ 50,000 waveforms/sec. |  |  |  |
| 1.27.2 | User manual must be in English language |  |  |  |
| **1.28** | **FUNCTION GENERATOR** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.28.1 | Output function: Sine, Square, Triangle, TTL  Low distortion sine wave  Supports 0.1 Hz to 3 MHz frequency range  Resolution: 0.1 Hz maximum  Amplitude Range: 10Vp-p (into 50 Ω load)  Impedance: 50 Ω ± 10%  DC Offset: < -5V - > 5V (into 50 Ω load)  Display: 6-digit LED display  Output Control: ON/OFF selector  Power Source: AC 240V,220V,110V 10%, 50/60Hz |  |  |  |
| 1.28.2 | User manual must be in English language |  |  |  |
| **1.29** | **MULTIMETER** |  |  |  |
|  | Quantity: 8 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.29.1 | Auto Ranging and Auto Power-OFF  Low battery indication  Data Hold  MAX Value hold function, Diode check, Continuity  Display: 3-1/2 Digit LCD display with 2000 display counts  Battery: 9V Battery (6F22 or 1604A Type)  DC Voltage range: 200mV, 2V, 20V, 200V, 600V  AC voltage range: 2V, 20V, 200V, 600V  Resistance range: 200 Ω, 2kΩ, 20k Ω, 200k Ω, 2MΩ, 20M Ω  DC and AC current range: 200µA, 2000µA, 20mA, 200mA, 10A  Frequency range: 20kHz  Accessories: K-type Temperature Probe, 9V Battery, Test lead set |  |  |  |
| 1.29.2 | User manual must be in English language |  |  |  |
| **1.30** | **HOME AUTOMATION TRAINER FOR LIGHTING CONTROL** |  |  |  |
|  | Quantity: 2 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.30.1 | The trainer must be designed for the study of the KNX/EIB technology allowing the student to conduct several practical experiments.  It should be designed as a modular system where industrial type components for lighting plants should be used allowing the final users to gradually assembling the circuits ranging from the basic configurations to the complex ones.  For each module, a schematic diagram must be shown to allow an easy operation of the unit. |  |  |  |
| 1.30.2 | It must include the following modules (not limited to):   * power unit   + including a residual current circuit breaker   + rated current In = 16A   + rated voltage Un = 230V   + minimum operating voltage Umin = 100V   + sensitivity Id = 30mA   + output terminals L and N, with monitor lamp * EIBus power supply   + To provide and monitor the power for the KNX system with safety extra low voltage   + rated input voltage: 120…230Vac, 50…60Hz   + rated input power intake: approx. 24VA   + rated output voltage (EIBus): 29Vdc   + permissible output range: 28…30Vdc   + rated output current: 640mA   + short-circuit output current: limited to 1.5A   + status LEDs * pushbutton interface   + for connecting various conventional switches/pushbuttons with volt-free contacts * double pushbutton   + for at least four switch buttons which operate as a switch pair and must allow to control actuators such as dimmers or shutters   … |  |  |  |
| 1.30.2 | …   * presence detector and brightness sensor   + to control the presence/motion detector and must also include a constant light level control * binary output   + with a device able to switch (capacitive, inductive, and resistive load) at least four mutually independent groups of electric consumers via potential-free outputs (relays) * universal dimmer   + with a switch and dim incandescent and halogen lamps   + protected from electronic short-circuit and overload with LED indication * infrared transmitter   + for wireless control of actuators   + IR transmitter   + IR receiver – decoder * sockets with lamps   + at least 2 E14 sockets for lamps   + complete with incandescent lamps * USB interface   + to connect a Personal Computer for addressing, parameter settings, visualizing, logging, and diagnosing bus connected devices |  |  |  |
| 1.30.3 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.31** | **HOME AUTOMATION TRAINER FOR SHUTTER CONTROL** |  |  |  |
|  | Quantity: 2 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.31.1 | The trainer must be designed for the study of the KNX/EIB technology allowing the student to conduct several practical experiments.  It should be designed as a modular system where industrial type components for lighting plants should be used allowing the final users to gradually assembling the circuits ranging from the basic configurations to the complex ones.  For each module, a schematic diagram must be shown to allow an easy operation of the unit. |  |  |  |
| 1.31.2 | It must include the following modules (not limited to):   * power unit   + including a residual current circuit breaker   + rated current In = 16A   + rated voltage Un = 230V   + minimum operating voltage Umin = 100V   + sensitivity Id = 30mA   + output terminals L and N, with monitor lamp * EIBus power supply   + To provide and monitor the power for the KNX system with safety extra low voltage   + rated input voltage: 120…230Vac, 50…60Hz   + rated input power intake: approx. 24VA   + rated output voltage (EIBus): 29Vdc   + permissible output range: 28…30Vdc   + rated output current: 640mA   + short-circuit output current: limited to 1.5A   + status LEDs * double pushbutton   + for at least four switch buttons which operate as a switch pair and must allow to control actuators such as dimmers or shutters   … |  |  |  |
| 1.31.2 | …   * shutter actuator   + to raise and lower blinds and gradually adjust slats   + provided with a channel that could control one motor mounted on an isolated module set up for wire connections * venetian drive   + with built-in limit switches and thermal overload protection   + inching mode for adjusting the angle of the slats   + venetian drive must be mounted on an isolated module set up for wire connections * programming software   + to design and configure intelligent home and building control installations with the KNX system * USB interface   + to connect a Personal Computer for addressing, parameter settings, visualizing, logging, and diagnosing bus connected devices |  |  |  |
| 1.31.3 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.32** | **HOME AUTOMATION TRAINER FOR SAFETY** |  |  |  |
|  | Quantity: 2 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.32.1 | The trainer must be designed for the study of the KNX/EIB technology allowing the student to conduct several practical experiments.  It should be designed as a modular system where industrial type components for lighting plants should be used allowing the final users to gradually assembling the circuits ranging from the basic configurations to the complex ones.  For each module, a schematic diagram must be shown to allow an easy operation of the unit. |  |  |  |
| 1.32.2 | It must include the following modules (not limited to):   * power unit   + including a residual current circuit breaker   + rated current In = 16A   + rated voltage Un = 230V   + minimum operating voltage Umin = 100V   + sensitivity Id = 30mA   + output terminals L and N, with monitor lamp * EIBus power supply   + To provide and monitor the power for the KNX system with safety extra low voltage   + rated input voltage: 120…230Vac, 50…60Hz   + rated input power intake: approx. 24VA   + rated output voltage (EIBus): 29Vdc   + permissible output range: 28…30Vdc   + rated output current: 640mA   + short-circuit output current: limited to 1.5A   + status LEDs * pushbutton interface   + for connecting various conventional switches/pushbuttons with volt-free contacts * smoke detector   + designed to early detect smoke or any significant increase in ambient temperature   + provided with a reset push button   … |  |  |  |
| 1.32.2 | …   * presence detector and brightness sensor   + to control the presence/motion detector and must also include a constant light level control   + Passive infrared (PIR) presence detection type, 288 sectors for detection   + Contrast with range 20-1000 Lux for brightness measuring type * binary output   + with a device able to switch (capacitive, inductive, and resistive load) at least four mutually independent groups of electric consumers via potential-free outputs (relays) * sockets with lamps   + at least 2 E14 sockets for lamps   + complete with incandescent lamps * programming software   + to design and configure intelligent home and building control installations with the KNX system * USB interface   + to connect a Personal Computer for addressing, parameter settings, visualizing, logging, and diagnosing bus connected devices |  |  |  |
| 1.32.3 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.33** | **HOME AUTOMATION TRAINER FOR HEATING/AIR CONDITIONING** |  |  |  |
|  | Quantity: 2 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.33.1 | The trainer must be designed for the study of the KNX/EIB technology allowing the student to conduct several practical experiments.  It should be designed as a modular system where industrial type components for lighting plants should be used allowing the final users to gradually assembling the circuits ranging from the basic configurations to the complex ones.  For each module, a schematic diagram must be shown to allow an easy operation of the unit. |  |  |  |
| 1.33.2 | It must include the following modules (not limited to):   * power unit   + including a residual current circuit breaker   + rated current In = 16A   + rated voltage Un = 230V   + minimum operating voltage Umin = 100V   + sensitivity Id = 30mA   + output terminals L and N, with monitor lamp * EIBus power supply   + To provide and monitor the power for the KNX system with safety extra low voltage   + rated input voltage: 120…230Vac, 50…60Hz   + rated input power intake: approx. 24VA   + rated output voltage (EIBus): 29Vdc   + permissible output range: 28…30Vdc   + rated output current: 640mA   + short-circuit output current: limited to 1.5A   + status LEDs * temperature controller   + to control heating systems and can be utilized as a two-step temperature controller (thermostat) or as a continuous controller (P or PI-controller)   + allow a normal regulation (heating) or a combined regulation (heating/cooling)   + send the regulation value either as a switching telegram (on/off) or as a regulation telegram (0...100%)   … |  |  |  |
| 1.33.2 | …   * valve actuator   + to control the valve opening/closing following the continuous regulation signal emitted by the temperature controller   + LCD display for human-machine operation * text display/clock switch   + configurable for showing/switching information like forced control, dimming, solar protection, scene control, display of text, date and time, operational messages, and warning/alarm messages   + Alarm messages must be activated along with an alarm sound * sockets with lamps   + at least 2 E14 sockets for lamps   + complete with incandescent lamps * programming software   + to design and configure intelligent home and building control installations with the KNX system * USB interface   + to connect a Personal Computer for addressing, parameter settings, visualizing, logging, and diagnosing bus connected devices |  |  |  |
| 1.33.3 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.34** | **HOME AUTOMATION TRAINER FOR SCENERY/EVENT** |  |  |  |
|  | Quantity: 2 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.34.1 | The trainer must be designed for the study of the KNX/EIB technology allowing the student to conduct several practical experiments.  It should be designed as a modular system where industrial type components for lighting plants should be used allowing the final users to gradually assembling the circuits ranging from the basic configurations to the complex ones.  For each module, a schematic diagram must be shown to allow an easy operation of the unit. |  |  |  |
| 1.34.2 | It must include the following modules (not limited to):   * power unit   + including a residual current circuit breaker   + rated current In = 16A   + rated voltage Un = 230V   + minimum operating voltage Umin = 100V   + sensitivity Id = 30mA   + output terminals L and N, with monitor lamp * EIBus power supply   + To provide and monitor the power for the KNX system with safety extra low voltage   + rated input voltage: 120…230Vac, 50…60Hz   + rated input power intake: approx. 24VA   + rated output voltage (EIBus): 29Vdc   + permissible output range: 28…30Vdc   + rated output current: 640mA   + short-circuit output current: limited to 1.5A   + status LEDs * double pushbutton   + for at least four switch buttons which operate as a switch pair and must allow to control actuators such as dimmers or shutters   … |  |  |  |
| 1.34.2 | …   * universal dimmer   + with a switch and dim incandescent and halogen lamps   + protected from electronic short-circuit and overload with LED indication * scene/event controller   + to define and process either scenes control and event programs   + to program and recall up to six scenes and to construct up to six event programs * sockets with lamps   + at least 2 E14 sockets for lamps   + complete with incandescent lamps * programming software   + to design and configure intelligent home and building control installations with the KNX system * USB interface   + to connect a Personal Computer for addressing, parameter settings, visualizing, logging, and diagnosing bus connected devices |  |  |  |
| 1.34.3 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.35** | **HOME AUTOMATION TRAINER FOR THE USE OF PLC, TOUCH PANEL & TIME SWITCH** |  |  |  |
|  | Quantity: 2 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.35.1 | The trainer must be designed for the study of the KNX/EIB technology allowing the student to conduct several practical experiments.  It should be designed as a modular system where industrial type components for lighting plants should be used allowing the final users to gradually assembling the circuits ranging from the basic configurations to the complex ones.  For each module, a schematic diagram must be shown to allow an easy operation of the unit. |  |  |  |
| 1.35.2 | It must include the following modules (not limited to):   * power unit   + including a residual current circuit breaker   + rated current In = 16A   + rated voltage Un = 230V   + minimum operating voltage Umin = 100V   + sensitivity Id = 30mA   + output terminals L and N, with monitor lamp   … |  |  |  |
| 1.35.2 | …   * EIBus power supply   + To provide and monitor the power for the KNX system with safety extra low voltage   + rated input voltage: 120…230Vac, 50…60Hz   + rated input power intake: approx. 24VA   + rated output voltage (EIBus): 29Vdc   + permissible output range: 28…30Vdc   + rated output current: 640mA   + short-circuit output current: limited to 1.5A   + status LEDs * double pushbutton   + for at least four switch buttons which operate as a switch pair and must allow to control actuators such as dimmers or shutters * binary output   + with a device able to switch (capacitive, inductive, and resistive load) at least four mutually independent groups of electric consumers via potential-free outputs (relays) * text display/clock switch   + configurable for showing/switching information like forced control, dimming, solar protection, scene control, display of text, date and time, operational messages, and warning/alarm messages   + Alarm messages must be activated along with an alarm sound   … |  |  |  |
| 1.35.2 | …   * sockets with lamps   + at least 2 E14 sockets for lamps   + complete with incandescent lamps * colour touch screen   + 5” TFT colour display   + to be used as a multi-functional display/control device for the KNX technology   + to display and control up to 100 KNX   + to store and recall different design for the display and operator interface * PLC and EIB/KNX communication module   + PLC could be programmed from the panel or from PC   + min. 8 digital inputs and 4 relay outputs   + EIB/KNX communication module must be conceived as slave to allow its interaction with the EIB system, and it must act as intermediary between the master PLC and the external EIB components through the EIBus cable   + EIB/KNX communication module must transfer the EIB telegrams to PLC and the functions of the PLC to the EIB system and any change of the output signal through the EIB bus * programming software   + to design and configure intelligent home and building control installations with the KNX system   … |  |  |  |
| 1.35.2 | …   * USB interface   + to connect a Personal Computer for addressing, parameter settings, visualizing, logging, and diagnosing bus connected devices |  |  |  |
| 1.35.3 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.36** | **PERSONAL COMPUTER** |  |  |  |
|  | Quantity: 16 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.36.1 | To be used with items from 1.11 to 1.26 and from 1.30 to 1.35 and relevant software supplied  Able to manage modern office suite software |  |  |  |
| 1.36.2 | Brand-name Personal Computer  Processor: Intel Core i5 or AMD Ryzen 5  OS: Microsoft Windows 10/11 Home  Memory: 8 GB of RAM  Storage: 240 GB SSD or larger  Monitor: 14″ – 17″ wide screen display  Network: 802.11ac (or better) Wi-Fi capability  USB Ports: 2  Keyboard: English layout (Egyptian Arabic layout is also recommended) |  |  |  |
| 1.36.3 | User manual must be in English language |  |  |  |
| **1.37** | **CHAIR FOR STUDENT** |  |  |  |
|  | Quantity: 32 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.37.1 | • Ergonomic seat  • Rigid Base frame  • Stackable with one another and on tables  • Carry handle in backrest  • Prevents tiring  • Robust and stable  • Easy to clean  • plastic glides to protect floors  • Cylindrical tubing legs, 2.5mm at least  • Height of seat, 46cm |  |  |  |
| **1.38** | **WORKBENCH** |  |  |  |
|  | Quantity: 12 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.38.1 | Large sized bilaminate wooden table and sturdy legs with compensation feet  Dimensions: 200 x 100 x 80 cm (LxWxH) |  |  |  |
| **1.39** | **CIVIL ELECTRICAL APPLICATION TRAINING SYSTEM FOR TEACHER/TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.39.1 | The training system for teacher/trainer must be used for the study of civil installations including assembling, installing, testing, and maintaining electrical wiring, equipment, appliances, etc., diagnosing and repairing.  It must be modular to permit replication of different application/experiments and coherent with the rest of the items of the Lot.  All the boards/modules must be safe, easy to install, with a self-explanatory schematic diagram to allow easy operativity.  Framework for installing the boards/modules must be included.  Set of leads must be included. |  |  |  |
| 1.39.2 | Following experiments/experiences must be possible (not limited to):   * single-point lighting installation with a socket * two-lamps lighting installation with a switch * two-point lighting installation * three-point lighting installation * four-point lighting installation * lighting installation with circuit breaking relay * lighting installation with switching relay * lighting installation with time relay * hot cathode fluorescent lamp installation * two-lamps low energy lighting installation with a switch * emergency lighting installation * control of the brightness with a dimmer from a single point * control of the brightness with a dimmer from single or multiple points * halogen and incandescent lamps controlled by automatic infrared switch with adjustable twilight * daily electromechanical time switch * signalling installation * single-control signalling installation * reciprocal control signalling installation * signalling installation with display indicator and reset pushbutton * ringing installation with control of door and main entrance * electric lock bell installation * two short distance reciprocal call house phones * two long distance reciprocal call house phones * two coupled house phones   … |  |  |  |
| 1.39.2 | …   * main house phone and two shunted house phones installation * intercommunicating house phone installation * connection between two derivatives and 1 external unit * installation for audience request * installation for hotel * fire-fight protection installation * anti-intrusion installation * connecting the ring * connecting alarm and light plate * house phone installation * video outdoor station * video house phone installation |  |  |  |
| 1.39.3 | The following boards/panels shall be part of the training system (not limited to):   * power supply * switches and commutator * intermediate switch * intermediate and 2-way switches * light pushbutton * bell/door opener pushbuttons * marked pushbuttons * single-phase mains socket * halogen lamps * low consumption fluorescent lamps * single-phase transformer * latching relays * stepping relay * staircase light timer   … |  |  |  |
| 1.39.3 | …   * Incandescent and fluorescent lamps * Bells * Bell and buzzer * Display signalling * Electric lock * Entry phone * Outdoor entry phone * Power supply for the entry phone * Emergency light * Stand-by battery * Fire, intrusion, and gas alarm control * Smoke detector * Thermal detector * Emergency pushbutton * Alarms * Gas detector * Signalling lamps * Microwave sensor * Passive infrared sensor * Perimeter sensor * Blinker * Video camera-monitor power supply * Video camera and outdoor station * Indoor monitor/intercom * Nurse board * Patient room * Dimmer * Pushbutton light regulator * Twilight switch   … |  |  |  |
| 1.39.3 | …   * Presence and twilight sensor * Timer switch * Passive infrared sensor wireless * Magnetic contact wireless * Smoke detector wireless * Interface control board |  |  |  |
| 1.39.4 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.40** | **INDUSTRIAL ELECTRICAL APPLICATION TRAINING SYSTEM FOR TEACHER/TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.40.1 | The training system for teacher/trainer must be used for the study of industrial installations including assembling, installing, testing, and maintaining electrical wiring, equipment, appliances, etc., diagnosing and repairing.  It must be modular to permit replication of different application/experiments and coherent with the rest of the items of the Lot.  All the boards/modules must be safe, easy to install, with a self-explanatory schematic diagram to allow easy operativity.  Framework for installing the boards/modules must be included.  Set of leads must be included. |  |  |  |
| 1.40.2 | Following experiments/experiences must be possible (not limited to):   * 1-pole control auxiliaries * Contactor * logic operators * contactor (self-supply, interlock and sequential control) * EX-OR operator * excitation and de-excitation delayed and static timer * thermal relay * manual star/delta starting and reverser * timed sequence control * pulse generator * star/delta starting (automatic and with reverser) * counter-current braking * manual and automatic starter with rotor resistances * speed variator and reverser for Dahlander motor * automatic reverser for 3-ph asynchronous motors * motor starting * star/delta starting and reverser with switch * star/delta starting with 2 rotation directions and switch * speed variator for Dahlander motor and with 2 rotation directions with switch * motor starting and control with limit switch * inductive sensor * capacitive sensor * photoelectric barrage sensor   … |  |  |  |
| 1.40.2 | …   * photoelectric reflecting sensor * level sensor * level variations and pulse programmer * sequence of motor starting * 2 rotation directions * with motor stop between the 2 operations with the cam programmer |  |  |  |
| 1.40.3 | The following boards/panels shall be part of the training system (not limited to):   * three-phase asynchronous squirrel cage motor * 1-phase transformer 230V-12V * slip ring three-phase induction motor * 3-phase power supply * DC power supply * Dahlander motor * emergency pushbutton * pushbuttons * pilot lamps * contactors * thermal relay * isolator * position sensor * star-delta starter * direct starter with inversion * inductive proximity sensor * capacitive proximity sensor * photoelectrical barrage sensor * photoelectrical reflecting sensor * level magnetic sensor   … |  |  |  |
| 1.40.3 | …   * flooding probes * star-delta starter with inversion * pole switching for Dahlander motors * pole switching unit with inversion (Dahlander) * level control * pulse counter * programmer * time relays * 3-pole switch   … |  |  |  |
| 1.40.4 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.41** | **HOME AUTOMATION TRAINING SYSTEM FOR TEACHER/TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.41.1 | The training system for teacher/trainer must be used for the study of the EIB/KNX technology.  It must be modular to permit replication of different application/experiments and coherent with the rest of the items of the Lot.  All the boards/modules must be safe, easy to install, with a self-explanatory schematic diagram to allow easy operativity.  A programming software to design and configure intelligent home and building control installations with the KNX system must be included.  Framework for installing the boards/modules must be included.  Set of leads must be included. |  |  |  |
| 1.41.2 | Subjects covered must include the following categories (not limited to):   * Lighting plant * Shutter control plant * Safety plant * Heating/Air Conditioning plant * Scenery module * Plant with PLC, Touch panel and Time switch |  |  |  |
| 1.41.3 | The following boards/panels shall be part of the training system (not limited to):   * power unit * EIBus power supply * Push-button interface * double push-button * smoke detector * temperature controller * presence detector and brightness sensor * binary output * universal dimmer * shutter actuator * valve actuator * infrared transmitter * scene/event controller * text display/clock switch * USB interface * sockets with lamps * venetian drive * colour touch screen * PLC and EIB/KNX communication |  |  |  |
| 1.41.4 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **1.42** | **PERSONAL COMPUTER FOR TEACHER/TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.42.1 | To be used with items from 1.39 to 1.41 and relevant software supplied  Able to manage modern office suite software |  |  |  |
| 1.42.2 | Brand-name All-In-One Personal Computer  Processor: Intel Core i5 or AMD Ryzen 5  OS: Microsoft Windows 10/11 Home  Memory: 16 GB of RAM  Storage: 500 GB SSD or larger  Monitor: min 23″ screen display  Network: 802.11ac (or better) Wi-Fi capability  USB Ports: 2  HDMI Port  Webcam  Wired Optical Mouse  Keyboard: English layout (Egyptian Arabic layout is also recommended) |  |  |  |
| 1.42.3 | User manual must be in English language |  |  |  |
| **1.43** | **INTERACTIVE WHITEBOARD** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.43.2 | Brand-name Interactive Whiteboard  Diagonal Size: 65”  Panel resolution: 3840 x 2160 (Landscape)  Touchscreen  Touch Pen Type: passive pen with magnet  Connectivity input video: 2 HDMI  Connectivity input USB: 2  Connectivity output external: RS232C, LAN, WiFi/BT  Power Supply: AC 100~240V 50/60Hz. |  |  |  |
| 1.43.3 | User manual must be in English language |  |  |  |
| **1.44** | **CHAIR FOR TEACHER/TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.44.1 | • Swivel chair with armrests  • Cushioned seat and backrest  • Gas lift height adjustment  • Circular footrest with casters  • Mechanism for adjusting height and inclination of backrest |  |  |  |
| **1.45** | **DESK FOR TEACHER/TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.45.1 | Top highly compressed multi-layered fine chipboard covered with plastic laminate and sturdy legs with compensation feet  Chest with 2 drawers with stop and key lock  Dimensions: cm 140 x 70 x 80 (LxWxH) |  |  |  |
| **1.46** | **WORKBENCH FOR THE TRAINING SYSTEMS** |  |  |  |
|  | Quantity: 3 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 1.46.1 | Large sized bilaminate wooden table and sturdy legs with compensation feet  Dimensions: 200 x 100 x 90 cm (LxWxH) |  |  |  |

**LOT 2: TRAINING EQUIPMENT FOR MECHATRONICS LAB**

| **1.**  **Item number** | **2.**  **Specifications required** | **3.**  **Specifications offered** | **4.**  **Notes, remarks,  ref to documentation** | **5.**  **Evaluation committee’s notes** |
| --- | --- | --- | --- | --- |
| **2.1** | **COMPUTER INTEGRATED MANUFACTURING SYSTEM TRAINER** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.1.1 | This system trainer must be used as a sample of an industrial automation manufacturing station to illustrate and practice about transversal applications in several technological areas such as automation, pneumatics, electronics, mechatronics, and process control in an interconnected ambient.  It must be composed of different units, each one simulating a single basic application that is commonly used in the industry.  It must be ready for future expansions with the possibility to be linked and interconnected to additional similar system trainers covering different industrial application to assemble a bigger manufacturing station.  Ready for Industry 4.0 application. |  |  |  |
| 2.1.2 | It must include the following units (not limited to):   * conveyor unit simulating an industrial handling system   + horizonthal flat belt conveyor   + 450 mm length   + Drive: 24V DC geared motor   + Sensors for material detection (capacitive and inductive type) and stop * linear transfer unit simulating an industrial distribution system   + linear transfer   + electro-pneumatic operated   + travel length 200 mm   + magnetic sensors * pick and place unit simulating an industrial automatic feeder system   + vertical and horizontal arms   + gripper   + electro-pneumatic operated   + max load capacity: 0.5Kg   + magnetic sensors * PLC unit simulating an industrial control system   + Embedded DI: 14/24Vdc   + Embedded DO: 10/24Vdc – Solid state MOSFET   + Ethernet 10/100 Base-T   + PTO/PWM support: min. 2   … |  |  |  |
| 2.1.2 | …   * + Embedded High Speed Counter: min. 6   + Basic instruction speed: 0.08µs   + 100 kb working memory/4 MB load memory   + Software for PLC programming including manuals in English language |  |  |  |
| 2.1.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **2.2** | **BASIC PNEUMATIC SYSTEM TRAINER** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.2.1 | This system trainer must be used as a basic training system for demonstrations and experiments in the pneumatic field.  It must include a metal inclined frame ready for assembling the pneumatic circuits.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity.  The trainer must be supplied with pipes (at least 70 m) and accessories to conduct the experiences/experiments easily and properly. |  |  |  |
| 2.2.2 | Following experiences/experiments must be possible (not limited to):   * + Circuits with one cylinder   + Circuits with speed adjustment   + Circuits with logic elements   + Circuits with delay systems   + Circuits with two cylinders with sequences without blocking signals   + Integrative controls of the circuits   + Circuits with emergency control   + Memory circuits |  |  |  |
| 2.2.3 | It must include the following components (not limited to):   * air supply, treatment and pressure regulator unit with emergency button/mushroom * 2 double-acting cylinders * 4 unstable 3/2 NC valves with roller lever control * 1 stable 3/2 NC valve with unidirectional roller lever control * 2 stable 5/2 valves with pneumatic control * 2 unstable 5/2 valves with pneumatic control and spring return * 2 AND logic valves * 2 OR logic valves * 1 NOT logic valve * 3 flux regulators for cylinders * 1 unidirectional flux regulator for cylinder * 1 Unidirectional flux regulator * 1 fast discharge valve * 1 pneumatic capacity * 1 distributor with 6 outputs |  |  |  |
| 2.2.4 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **2.3** | **BASIC ELECTROPNEUMATIC SYSTEM TRAINER** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.3.1 | This system trainer must be used as a basic training system for demonstrations and experiments in the electropneumatic field.  It must include a metal inclined frame ready for assembling the electropneumatic circuits.  Ready for connection with a PLC.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity.  The trainer must be supplied with pipes (at least 40 m), cables and accessories to conduct the experiences/experiments easily and properly. |  |  |  |
| 2.3.2 | Following experiences/experiments must be possible (not limited to):   * + Circuits with single and double-acting (DA) cylinders   + Circuits with basic logic functions   + Circuits with single cycle of a DA cylinder   + Circuits with functions performed by a relay   + Circuits with timers   + Circuits with continuous cycle of a single DA cylinder   + Circuits with multiple cylinder sequences   + Circuits with continuous cycle of two DA cylinders   + Circuits with continuous cycle of four DA cylinders |  |  |  |
| 2.3.3 | It must include the following components (not limited to):   * air supply, treatment, and pressure regulator unit with emergency button/mushroom * 1 power supply with output 24 Vdc to provide the supply for contactors, proximity switches and coils * 6 double-acting cylinders with magnetic piston * 12 flow unidirectional regulators for cylinders * 1 distributor with 6 outputs * 4 stable 5/2 valves with pneumatic control * 2 unstable 5/2 valves with pneumatic control and spring return * 10 unstable 2/2 electro valves with spring return * 5 unstable pushbuttons with 1 NO and 1 NC contacts each, * 1 selector switch with 2 NO and 2 NC contacts, * 5 contactors with 6 NO and 6 NC auxiliary contacts each, * 1 adjustable on-delay time relay with 1 NO and 1 NC contacts, * 1 adjustable off-delay time relay with 1 NO and 1 NC contacts, * 3 signalling lamps, * 12 proximity switches for the cylinders, * 10 coils for the electovlaves, |  |  |  |
| 2.3.4 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **2.4** | **NOISELESS COMPRESSOR** |  |  |  |
|  | Quantity: 12 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.4.1 | To be used with items from 2.1 to 2.3 for supplying the needed air at the pressure required |  |  |  |
| 2.4.2 | Tank capacity: min 20 litres  Air intake: more than 45 litres/min  Working pressure: at least 6 bar  Motor power: less than 500W  Noise level: less than 45 dB, |  |  |  |
| 2.4.3 | User manual must be in English language |  |  |  |
| **2.5** | **BASIC HYDRAULIC SYSTEM TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.5.1 | This system trainer must be used as a basic training system for demonstrations and experiments in the hydraulic field.  It must consist in a bench with a T-slot aluminium board where supplied hydraulic components can be mounted/dismounted freely with a simple and quick operation.  The bench must include 4 wheels to facilitate its movement, and at least 2 drawers for storing components, hoses, and accessories, a supply unit along with a control box.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. |  |  |  |
| 2.5.2 | Following experiences/experiments must be possible (not limited to):   * + 4/3 manual valve commutation circuit   + speed regulation performance experiment of the throttle valve   + adjustable speed manual commutation loop   + hydraulic cylinder parallel circuit test   + hydraulic cylinder series synchronous circuit   + regulating pressure circuit of the hydraulic pump   + remote regulating pressure circuit of multiple relief valves |  |  |  |
| 2.5.3 | The supply unit of system trainer must include:  - 1 manual valve  - 1 motor  - 1 oil pump controlled by start and stop pushbuttons with indicators  - 1 relief safety valve  - 1 pressure meter  - 1 oil tank of at least 25l  - 1 return oil filter  - 1 level scale  - 1 pressure accumulator tank  - and 1 cut-off valve  The control box must include:  - 1 three-phase breaker  - 1 overload relay  - 3 operation pushbuttons  - 1 power input plug  - 2 power sockets for motor  - 2 power cables |  |  |  |
| 2.5.4 | It must include the following components (not limited to):   * 1 reducing pressure valve * 2 pressure relief valve * 2 one-way flow restrictor * 1 shut off ball valve * 1 two-way flow restrictor * 1 “T” distributor with pressure gauge * 1 cross distributor, 4 connection * 1 pressure compensated one way flow regulator * 1 four connections distributor on manifold with pressure gauge * 1 one-way restrictor (non-return valve) * 1 double acting differential cylinder * 1 double acting cylinder * 1 piloted one-way restrictor * 1 3/2 manual acting valve, spring return * 1 4/2 manual acting valve, spring return * 1 4/3 manual acting valve, spring return * set of tubes for testing pressure drops * set of hoses with quick female connectors |  |  |  |
| 2.5.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **2.6** | **ELECTROHYDRAULIC EXPANSION KIT** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.6.1 | This expansion kit must be used in conjunction with item 2.5 to add functionality for demonstrations and experiments in the electrohydraulic field.  It must consist in various electrohydraulic components, a power supply unit and a control unit  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. |  |  |  |
| 2.6.2 | Following experiences/experiments must be possible (not limited to):   * + button and lamp control experiment   + relay control   + solenoid valve directional circuit   + pressure relay with auto reciprocating circuit   + auto reciprocating circuit controlled by stroke switch   + time delay circuit controlled by timer relay |  |  |  |
| 2.6.3 | It must include the following components (not limited to):   * power supply module (24 Vdc/3A output and overload and short-circuit protection) * control unit (four pushbuttons, one electronic timer, 1 switch, 4 lamps, and terminals for positive and negative voltages) * relay module with 3 units with 4 auxiliary NC/NO contacts each, with an ON/OFF light indicator for each relay, and with spark suppressing * 1 4/2 solenoid valve with spring return * 1 4/3 solenoid valve with spring centred * 3 limit switches with 1 NC and 1 NO contacts each with support * 1 adjustable pressure switch * set of cables and connectors for solenoids, and for pressure and limit switches |  |  |  |
| 2.6.4 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **2.7** | **ADVANCED HYDRAULIC EXPANSION KIT** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.7.1 | This extension kit must be used in conjunction with item 2.5 to add functionality for demonstrations and experiments in the advanced hydraulic field.  It must consist in various hydraulic components.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. |  |  |  |
| 2.7.2 | Following experiences/experiments must be possible (not limited to):   * + adopting pilot relief valve to regulate pressure circuit   + single-stage pressure relief circuit   + adopting accumulator’s packing circuit |  |  |  |
| 2.7.3 | It must include the following components (not limited to):   * 1 double-acting cylinder * 1 distributor with four connections on a manifold with pressure gauge * 1 pressure reducing valve with 3 ways * 1 pressure relief valve with spool and clamping * 1 piloted pressure relief * valve with spool, * 1 hydraulic motor * 1 2/2 valve, ball actuated with spring return * 1 counterweight at least 8Kg with protection * 1 hydraulic diaphragm accumulator with 2 manual valves and a relief security valve * hoses with quick female connectors |  |  |  |
| 2.7.4 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **2.8** | **OIL FOR HYDRAULIC SYSTEM TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.8.1 | To be used with items from 2.5 to 2.7 |  |  |  |
| 2.8.2 | Premium-grade mineral-based hydraulic oil  good anti-wear properties  good protection  meeting ISO standards  rust, corrosion and oxidation inhibited  good thermal stability properties  minimum quantity: 20l  viscosity: approx. 21 @ 40°C/4.15 @ 100°C  density: approx. 0.862 Kg/L |  |  |  |
| **2.9** | **SENSORS CONTROL AND PLC PROGRAMMING SYSTEM TRAINER** |  |  |  |
|  | Quantity: 2 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.9.1 | This system trainer (based on a conveyor belt unit simulating an industrial handling system) must be used as a basic training system to learn and familiarize about real-life PLC application in automation and mechatronics industries.  Its operation and control could be demonstrated with various electro-mechanical components that shall be controlled by a PLC.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. |  |  |  |
| 2.9.2 | Following experiences/experiments must be possible (not limited to):   * + control and command activities   + generic PLC programming   + operational analysis of sensors   + operational analysis of belt drives   + creation of supervision application   + fault and diagnostics |  |  |  |
| 2.9.3 | It must include the following components (not limited to):   * belt conveyor, * optical sensor, * capacitive sensor, * inductive sensor, * built-in PLC, * interface with terminals for digital I/Os and switches for inputs, * LEDs for the sensors, * LEDs for the outputs, * outputs for 24Vdc power supply * various material (plastic, aluminium, and iron) objects suitable for the system * accessories, wiring leads, programming cable, … |  |  |  |
| 2.9.4 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **2.10** | **SENSORS AND TRANSDUCERS SYSTEM TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.10.1 | This system trainer must be used as a basic training system to learn and familiarize about the operating principles of the sensors/transducers that are most widely used in industry.  It must be subdivided in sections: one section must gather the group of input and output transducers; another section must gather the signal-conditioning systems as well as the instrumentation.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. |  |  |  |
| 2.10.2 | Following experiences/experiments must be possible (not limited to):  - Investigation about Practical Control System  - Investigation of characteristics in a Proportional Control System  - Characteristic of a Speed Control System  - Application of Counter/Timer as a Time Meter  - Application of Counter/Timer as a Simple Counter  - The Characteristic of a LED Bargraph display unit  - The Moving Coil Meter Characteristic  - Comparison between the Digital Bargraph and Moving Coil Meters  - To enlarge the voltages scale of the Moving Coil Meter  - Variation of output voltage in a potentiometer used as a position transducer  - … |  |  |  |
| 2.10.2 | …  Characteristics of the of Continuous Current Amplifiers 1,2 and x 100  - Characteristics of the power and Buffer Amplifier  - Characteristics of a current amplifier and buffer amplifier application  - Characteristics of an Inverter Amplifier  - Characteristics of a Differential Amplifier  - Characteristics of a Voltage to Current Converter  - Characteristics of a Current to Voltage Converter  - Characteristics of a Voltage to Frequency Converter  - Characteristics of a Frequency to Voltage Converter  - Characteristics of a Full Wave Rectifier  - Characteristics of a Comparator  - Characteristics of an Alarm Oscillator Circuit  - Characteristics of an Electronic Switch  - Characteristics of a Summing Amplifier  - Characteristics of an Integrator  - Characteristics of a Differentiator Circuit  - Characteristics of a Sample and Hold Circuit  - The Buffer as a compensator of the load effect in the potentiometer output voltage  - Servo Potentiometer. Variation of the output voltage as a function of its position  - Measure of Resistance using a Wheatstone Bridge Circuit  - Voltage Measurement using "Null Balance"  - The Integrated Circuit LM35 and Temperature Characteristics  … |  |  |  |
| 2.10.2 | …  - NTC Thermistor Characteristics  - Characteristic of the NTC thermistor used in an alarm circuit (doble thermistor)  - Type "K" thermocouple characteristics  - Photovoltaic cell Characteristics  - Phototransistor Characteristics  - Light Intensity Detector  - Characteristics of PIN Photodiode  - Linear Variable Differential Transformer Characteristic (LVDT)  - Strain Gauge Characteristics  - Characteristic of a slotted Optoelectronic Transducer and its application for count and speed measurement  - Characteristics of the reflective optotransducers and the Gray Code Disk  - Characteristics of an Inductive Transducer  - Characteristics of the Hall Effect Transducer  - Characteristics of DC Permanent Magnet Tachogenerator  - Characteristics of a Dynamic Microphone  - Characteristics of the ultrasonic receiver  - Characteristics of the Moving Coil Speaker  - Characteristic of a Buzzer  - Characteristic of DC Relay  - Characteristic of a Permanent Magnet Motor  - Diode temperature sensor  - Characteristics of the humidity sensor  - Characteristics of the flow sensor  - Characteristics of the pressure sensor |  |  |  |
| 2.10.3 | It must include the following input sensors/transducers (not limited to):   * linear slide potentiometer * rotary potentiometer * precision servo potentiometer * Wheatstone bridge circuit * thermistors NTC * RTD platinum sensor * IC temperature sensor * Thermocouple * Phototransistor * PIN photodiode * photoconductive cell * photovoltaic cell * LVDT * extensiometric transducer * linear position sensor * air flow sensor * air pressure sensor * humidity sensor * opto-electronic sensor * opto-reflecting sensor * inductive sensor * Hall effect sensor * dc tach generator * microphone   It must include the following output sensors/transducers (not limited to):   * electric resistance * incandescent lamp * buzzer   … |  |  |  |
| 2.10.3 | …   * moving coil loudspeaker * ultrasonic transmitter * ultrasonic receiver * dc solenoid * dc relay * dc motor   It must include the following output signal conditioning components (not limited to):   * timer/counter * bar graphs * dc voltmeter * dc amplifiers * ac amplifiers * power amplifiers * current amplifiers * buffer amplifier * inverting amplifier * differential amplifier * V/F converter * F/V converter * I/V converter * V/I converter * complete wave rectifier * hysteresis switchable comparator * alarm oscillator * electronic switch * oscillator * filter   … |  |  |  |
| 2.10.3 | …   * switchable low-pas filter * power supply * adding amplifier * integrator with switchable time constant * instrumentation amplifier * sample & hold circuit * gain and offset control amplifier |  |  |  |
| 2.10.4 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **2.11** | **PROCESS CONTROL SYSTEM TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.11.1 | This system trainer must be used as a basic training system to learn and familiarize about the research of ON/OFF, proportional (P), integral (I), derivative (D), simple or combined, control loops in the field of process.  Continuous parameters like liquid level, pressure, flow, and temperature shall be transmitted and controlled by one of the control loops mentioned.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. |  |  |  |
| 2.11.2 | Following experiences/experiments must be possible (not limited to):  - study of the level, flow, pressure, and temperature sensors  - study of the characteristics of the pump and of the motor pump  - study of the characteristics of the static process and of the time constants  - ON-OFF, P, PI, PD and PID closed loop control of the level  - P, PI, PD and PID closed loop control of the flow  - ON-OFF, P, PI, PD and PID closed loop control of the temperature  - ON-OFF control of the level with the pressure sensor  - measurement of the characteristics of the heater  - pressure sensor as level sensor |  |  |  |
| 2.11.3 | It must include the following components (not limited to):   * power supply * liquid tank with a capacity of 18 litres * motor recirculation pump * motor valve * motor pump with thermal protection and flow check valve * flow sensor * pipelines * delivery valve * flow meter * visual flowmeter   … |  |  |  |
| 2.11.3 | …   * manually operated valve (to control water flow) * Pressurized vessel (capacity 4 litres) * capacitive level sensor and a metric scale for measuring the water level (cm or mm) * float switch (to detect the level of water within the pressurized tank) * heating element; temperature sensor (PT100) and a Thermometer for measuring the temperature inside the process tank (°C or °F) * pressure sensor and pressure gauge for measuring the pressure (bar or psi) * 4 types of valves (3 manual and 1 controlled) * safety valve * input’s interface (sensors to manage level, flow, temperature, pressure) * control’s interface (ON/OFF, ON/OFF with hysteresis, P, I, D and combination) * output’s interface (actuators for: linear driver for the pump; driver for motor valve; PWM driver for the heater; ON/OFF driver for the level valve) |  |  |  |
| 2.11.4 | The system trainer must be equipped with the following accessories:  - test leads (30 pcs)  - oscilloscope cable(s)  - power cable(s)  - load connector cable, 3m  - parallel/serial/USB port cable, 3m  - pump to empty the tank  - screwdriver(s)  - interfaceable and computerized data acquisition unit with 8 analogue inputs, 2 relays and 2 analogue outputs  - software to control the process allowing the control/performance of the following applications:  • measurement system synoptic  • PID and ON/OFF controllers  • acquisition unit  • plots  • data printing  • system parameters setting  • student parameters setting |  |  |  |
| 2.11.5 | User manual, covering theoretical and practical topics must be in English language |  |  |  |
| **2.12** | **PERSONAL COMPUTER** |  |  |  |
|  | Quantity: 7 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.12.1 | To be used with items 2.1, 2.9 and 2.11 and relevant software supplied  Able to manage modern office suite software |  |  |  |
| 2.12.2 | Brand-name Personal Computer  Processor: Intel Core i5 or AMD Ryzen 5  OS: Microsoft Windows 10/11 Home  Memory: 8 GB of RAM  Storage: 240 GB SSD or larger  Monitor: 14″ – 17″ wide screen display  Network: 802.11ac (or better) Wi-Fi capability  USB Ports: 2  Keyboard: English layout (Egyptian Arabic layout is also recommended) |  |  |  |
| 2.12.3 | User manual must be in English language |  |  |  |
| **2.13** | **CHAIR FOR STUDENT** |  |  |  |
|  | Quantity: 32 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.13.1 | • Ergonomic seat  • Rigid Base frame  • Stackable with one another and on tables  • Carry handle in backrest  • Prevents tiring  • Robust and stable  • Easy to clean  • plastic glides to protect floors  • Cylindrical tubing legs, 2.5mm at least  • Height of seat, 46cm |  |  |  |
| **2.14** | **WORKBENCH** |  |  |  |
|  | Quantity: 16 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.14.1 | Large sized bilaminate wooden table and sturdy legs with compensation feet  Dimensions: 200 x 100 x 80 cm (LxWxH) |  |  |  |
| **2.15** | **PERSONAL COMPUTER FOR TEACHER/TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.15.1 | To be used with the software supplied  Able to manage modern office suite software |  |  |  |
| 2.15.2 | Brand-name All-In-One Personal Computer  Processor: Intel Core i5 or AMD Ryzen 5  OS: Microsoft Windows 10/11 Home  Memory: 16 GB of RAM  Storage: 500 GB SSD or larger  Monitor: min 23″ screen display  Network: 802.11ac (or better) Wi-Fi capability  USB Ports: 2  HDMI Port  Webcam  Wired Optical Mouse  Keyboard: English layout (Egyptian Arabic layout is also recommended) |  |  |  |
| 2.15.3 | User manual must be in English language |  |  |  |
| **2.16** | **INTERACTIVE WHITEBOARD** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.16.2 | Brand-name Interactive Whiteboard  Diagonal Size: 65”  Panel resolution: 3840 x 2160 (Landscape)  Touchscreen  Touch Pen Type: passive pen with magnet  Connectivity input video: 2 HDMI  Connectivity input USB: 2  Connectivity output external: RS232C, LAN, WiFi/BT  Power Supply: AC 100~240V 50/60Hz. |  |  |  |
| 2.16.3 | User manual must be in English language |  |  |  |
| **2.17** | **CHAIR FOR TEACHER/TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.17.1 | • Swivel chair with armrests  • Cushioned seat and backrest  • Gas lift height adjustment  • Circular footrest with casters  • Mechanism for adjusting height and inclination of backrest |  |  |  |
| **2.18** | **DESK FOR TEACHER/TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 2.18.1 | Top highly compressed multi-layered fine chipboard covered with plastic laminate and sturdy legs with compensation feet  Chest with 2 drawers with stop and key lock  Dimensions: cm 140 x 70 x 80 (LxWxH) |  |  |  |

**LOT 3: TRAINING EQUIPMENT FOR GREEN ENERGY LAB**

| **1.**  **Item number** | **2.**  **Specifications required** | **3.**  **Specifications offered** | | | | **4.**  **Notes, remarks,  ref to documentation** | | | | **5.**  **Evaluation committee’s notes** | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **3.1** | **SOLAR AND WIND ENERGY SYSTEM TRAINER** |  | | | |  | | | |  | | | |
|  | Quantity: 1 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.1.1 | This system trainer must be used as a basic training system to learn and familiarize about production of green energy using photovoltaic solar panels and wind turbine.  It must consist of photovoltaic and wind energy equipment for generating electrical energy.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. |  | | | |  | | | |  | | | |
| 3.1.2 | Following experiences/experiments must be possible (not limited to):  - how the solar irradiance affects the output voltage of the solar panel  - calculation of the inner resistance of the solar panels  - tracing a daily irradiance graph  - shading effect, covering the panel with different materials, such as paper, cardboard, etc.  - how the wind speed affects the output voltage of the wind turbine  - wind turbine braking mode  - charging the battery with solar energy  - charging the battery with wind energy  - powering a DC load with both solar and battery energy  - testing the whole system |  | | | |  | | | |  | | | |
| 3.1.3 | It must include the following components (not limited to):   * photovoltaic panels, min. 85W, 12V * DC wind turbine, 12V * reclinable metal frames for supporting the photovoltaic panels * electronic current regulator, with LCD display, output 12 V, 30 A * inverter, output at mains voltage, 12 V, 30 A, 300 W * battery controller, 0‐600 V, 32A with battery min. 100 Ah * lamps at mains voltage, dichroic 35W and LED 3W, with independent switches   … |  | | | |  | | | |  | | | |
| 3.1.3 | …   * 12V lamps that can be switched on independently one from the others, one dichroic at min. 20 W and one with LED, min. 3W * cables, connectors, lamps, switches, protections, etc. as required for running properly |  | | | |  | | | |  | | | |
| 3.1.4 | User manual, covering theoretical and practical topics must be in English language |  | | | |  | | | |  | | | |
| **3.2** | **OFF-GRID PHOTOVOLTAIC SOLAR ENERGY PRODUCTION SYSTEM TRAINER** |  | | | |  | | | |  | | | |
|  | Quantity: 1 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.2.1 | This system trainer must be used as a basic training system to learn and familiarize about production of green energy studying the off-grid photovoltaic solar energy systems.  It must be composed of photovoltaic panel(s) and a metal frame to mount/install various didactic boards/modules to perform different experiences/experiments.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. |  | | | |  | | | |  | | | |
| 3.2.2 | Following experiences/experiments must be possible (not limited to):  - measurement of load current, voltage, and power  - measurement of irradiance and panel temperature and how they affect the performances of the panel(s)  - determination of the solar panel voltage-irradiance, current-voltage, and current-power curves, no-load and DC/AC variable load  - electrical accymulator charging and regulation  - supplying a DC/AC variable load using the panel(s) and the battery(ies) together  - dimensioning criteria  - testing the whole system |  | | | |  | | | |  | | | |
| 3.2.3 | It must include the following components (not limited to):   * photovoltaic panel(s), min. 85W, 12V with sensors for measuring irradiation and temperature * reclinable metal frames for supporting the photovoltaic panel(s) * electrical accumulator(s) * acquisition and data analysis software * connection cables, set of leads, tools, …, for operating the system trainer as required vertical supporting frame for boards/modules, including:   + electrical accumulator(s) protection system (12 V, 30 A) with a circuit breaker and LED indicators   … |  | | | |  | | | |  | | | |
| 3.2.3 | …   * + rheostat including a knob for varying the resistance   + measuring instruments for DC, AC, and environmental parameters with RS232/RS485/USB port(s) for connection with external PC running the acquisition software and other boards/modules   + display(s) showing DC voltage, power, and current, AC voltage, power and current, and solar irradiation   + regulator for charging battery(ies) with the current produced, protected against overload and providing temperature compensation, and different charging modes of the battery(ies)   + DC load simulated with lamps with independent switches   + AC load simulated with halogen and LED lamps with independent switches   + DC to AC inverter with control circuits against the output overload and against the deep discharge of the battery and indicators about the status of the board/module and of the battery(ies) and output to the mains (230 Vac) |  | | | |  | | | |  | | | |
| 3.2.4 | User manual, covering theoretical and practical topics must be in English language |  | | | |  | | | |  | | | |
| **3.3** | **WIND ENERGY PRODUCTION SYSTEM TRAINER** |  | | | |  | | | |  | | | |
|  | Quantity: 1 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.3.1 | This system trainer must be used as a basic training system to learn and familiarize about production of electricity’s generation by means of wind power.  It must be possible to change the air flow reaching the turbine and to perform experiments both in no-load and load conditions.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. |  | | | |  | | | |  | | | |
| 3.3.2 | Following experiences/experiments must be possible (not limited to):  - wind turbines installation,  - understanding the wind tunnel simulator,  - wind measurements using anemometers,  - wind turbines starting / inertia,  - 3 bladed horizontal axis wind turbine characteristics  - 6 bladed horizontal axis wind turbine characteristics  - 2 bladed horizontal axis wind turbine characteristics  - interaction of the turbine with the wind tunnel |  | | | |  | | | |  | | | |
| 3.3.3 | It must include the following components (not limited to):   * wind tunnel including:   + an industrial fan with a flow straightener   + a wind turbine with a variable number of blades with variable orientation * an anemometer for measuring the wind speed at the sides of the fan, and at the turbine outlets with the possibilities to mount it inside or outside the wind tunnel * a control module including:   + inverter to control the fan speed   + display to show electrical and mechanic parameters (SI and Imperial measuring units)   + variable resistive load   + analogue signal output for external measuring of voltage, current, power, air speed, and generator rotation speed   + RS232/RS484/USB port(s) for connection with external PC running the acquisition software and other boards/modules   + protected with an emergency button * acquisition and data analysis software with the possibility to save/retrieve data in different formats for using them with other applications * connection cables, set of leads, tools, …, for operating the system trainer as required |  | | | |  | | | |  | | | |
| 3.3.4 | User manual, covering theoretical and practical topics must be in English language |  | | | |  | | | |  | | | |
| **3.4** | **OFF-GRID WIND ENERGY PRODUCTION SYSTEM TRAINER** |  | | | |  | | | |  | | | |
|  | Quantity: 1 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.4.1 | This system trainer must be used as a basic training system to learn and familiarize about production of electricity’s generation by means of wind power in an off-grid system with electrical accumulator.  It must be possible to operate the turbine without wind via a DC brushless motor.  It must be composed of a motor-generator benchtop unit and a metal frame to mount/install various didactic boards/modules to perform different experiences/experiments.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. |  | | | |  | | | |  | | | |
| 3.4.2 | Following experiences/experiments must be possible (not limited to):  - knowledge of the components of the wind turbine  - braking of the wind turbine  - wind power calculation  - dimensioning an off-grid wind system  - charging and regulating a battery  - using the power stored in a battery to supply a DC load  - using the wind power and the power stored in a battery to supply an AC load,  - autonomy of the system with different loads |  | | | |  | | | |  | | | |
| 3.4.3 | It must include the following components (not limited to):   * a motor/generator benchtop unit simulating a wind turbine:   + a DC brushless motor   + a wind turbine (DC permanent magnet generator) mounted on guides for sliding and fixing the generator and on an anti-vibration system * electrical accumulator:   + AGM (Absorbent Glass Mat)   + 12V, 100 Ah   + 1200A (5s) max discharge current   + rechargeable * acquisition and data analysis software * connection cables, set of leads, tools, …, for operating the system trainer as required vertical supporting frame for boards/modules, including: * a controller to drive the DC brushless motor operated via a software able to:   + - set the parameters of the system     - draw graphics curves     - real-time monitoring of the system (power, torque, speed, …) * a battery protection board/module:   + - circuit breaker     - LED indicator(s) for the accumulator connection   … |  | | | |  | | | |  | | | |
| 3.4.3 | …   * DC to AC off-grid inverter with control circuits against the output overload and against the deep discharge of the battery and indicators about the status of the board/module and of the battery(ies) and output to the mains (230 Vac) * DC load simulated with lamps with independent switches * AC load simulated with halogen and LED lamps with independent switches * anemometer with sensors for wind speed and direction * multifunction AC, DC, and environmental measurement of wind energy parameters including RS232/RS484/USB port(s) for connection with external PC running the acquisition software and other boards/modules and in addition with display(s) and instruments to check:   + - aerogen electrical data     - load or accumulator electrical data     - AC electrical data regarding the load connected to the inverter outputs     - wind sensors data |  | | | |  | | | |  | | | |
| 3.4.4 | User manual, covering theoretical and practical topics must be in English language |  | | | |  | | | |  | | | |
| **3.5** | **ON-GRID WIND AND SOLAR ENERGY PRODUCTION SYSTEM TRAINER** |  | | | |  | | | |  | | | |
|  | Quantity: 1 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.5.1 | This system trainer must be used as a basic training system to learn and familiarize about production of electricity’s generation by means of photovoltaic solar panels and wind power in an on-grid system.  It must be possible to operate the turbine without wind via a DC brushless motor.  It must be composed of a motor-generator benchtop unit and a metal frame to mount/install various didactic boards/modules to perform different experiences/experiments.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. |  | | | |  | | | |  | | | |
| 3.5.2 | Following experiences/experiments must be possible (not limited to):  - measurement of the solar irradiance by changing the inclination and the azimuth of the panel  - study of the panel shadowing  - determination of the solar panel voltage-irradiance, current-voltage, and current-power curves, no-load and DC/AC variable load  - measurement of the electricity delivered to the mains  - measurement of the electricity generated by the solar panel, delivered/taken from the mains, and the loading  - efficiency of the inverter  - response of a PV system to a mains failure  … |  | | | |  | | | |  | | | |
| 3.5.2 | …  - knowing the components of a wind turbine  - braking the wind turbine  - calculating the power of the wind  - measuring the electrical power of the wind turbine  - wind turbine with load  - measurement of the electricity generated by the wind turbine, delivered/taken from the mains, and the loading  - efficiency of the whole on-grid wind energy system  - response of a wind system to a mains failure  - energy balance |  | | | |  | | | |  | | | |
| 3.5.3 | It must include the following components (not limited to):   * photovoltaic panel(s), min. 85W, 12V with sensors for measuring irradiation and temperature * reclinable metal frames for supporting the photovoltaic panel(s) * a motor/generator benchtop unit simulating a wind turbine:   + a DC brushless motor   + a wind turbine (DC permanent magnet generator) mounted on guides for sliding and fixing the generator and on an anti-vibration system * acquisition and data analysis software   … |  | | | |  | | | |  | | | |
| 3.5.3 | …   * connection cables, set of leads, tools, transformer, …, for operating the system trainer as required * vertical supporting frame for boards/modules, including: * a rheostat with a knob for changing the resistance in the range 0 ÷ 80Ω, to load the photovoltaic panel(s) and determine its voltage/current characteristic curve * multifunction AC, DC, and environmental measurement of the photovoltaic solar energy parameters including RS232/RS484/USB port(s) for connection with external PC running the acquisition software and other boards/modules and in addition with display(s) and instruments to check:   + - solar electrical data     - load or accumulator electrical data     - AC electrical data regarding the load connected to the inverter outputs     - solar panel sensors data * solar grid-tie power inverter, with maximum current: 30A, rated power, min. 300 W, and 12Vdc input voltage, and generation of pure sine wave, MPPT – optimization of power output, island protection, reverse polarity protection, constant power output, and low distortion output on all ranges features included   … |  | | | |  | | | |  | | | |
| 3.5.3 | …   * wind grid-tie power inverter, peak power min. 300 W, and dump resistor * a controller to drive the DC brushless motor operated via a software able to:   + - set the parameters of the system     - draw graphics curves     - real-time monitoring of the system (power, torque, speed, …) * resistive load, single or three-phas, variable in steps * AC load simulated with halogen and LED lamps with independent switches * anemometer with sensors for wind speed and direction * differential magneto-thermal switch to disconnect the wind energy system from the mains * network distributor to provide AC and DC outputs with status LED(s) and power switch multifunction AC, DC, and environmental measurement of wind energy including RS232/RS484/USB port(s) for connection with external PC running the acquisition software and other boards/modules and in addition with display(s) and instruments to check:   + - aerogen electrical data     - load or accumulator electrical data     - AC electrical data regarding the load connected to the inverter outputs     - wind sensors data   … |  | | | |  | | | |  | | | |
| 3.5.3 | …   * energy measurement unit as an instrument for low, medium, and high voltage network. It must be able to measure voltage, current, power, energy, frequency, run hour, THD |  | | | |  | | | |  | | | |
| 3.5.4 | User manual, covering theoretical and practical topics must be in English language |  | | | |  | | | |  | | | |
| **3.6** | **LIGHT SOURCE FRAME FOR THE SYSTEM TRAINERS** |  | | | |  | | | |  | | | |
|  | Quantity: 2 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.6.1 | To be used with items 3.2 and 3.5 to simulate the irradiance of the sun throughout the day.  Light intensity shall be manually or automatically controlled |  | | | |  | | | |  | | | |
| 3.6.2 | - local/remote dimmer to control the light source  - at least 12 halogen lamps, more than 100 W each  - metal frame with wheels  - 10A magneto-thermal switch, 30mA  - control modes: local, Modbus or analogue 0-10V with switch  - potentiometer for manual control of the light intensity,  - power supply: 230Vac,  - power: approx. 1400W |  | | | |  | | | |  | | | |
| 3.6.3 | User manual must be in English language |  | | | |  | | | |  | | | |
| **3.7** | **FUEL CELLS ENERGY PRODUCTION SYSTEM TRAINER** |  | | | |  | | | |  | | | |
|  | Quantity: 1 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.7.1 | This system trainer must be used as a basic training system to learn and familiarize about production of electricity’s generation by means of Proton-exchange membrane (PEM) fuel cell and hydrogen.  The system trainer must be flexible and modular,  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. |  | | | |  | | | |  | | | |
| 3.7.2 | Following experiences/experiments must be possible (not limited to):  - familiarize with the components of the system  - evaluate the performance of the PEM fuel cell with fixed loads, without DC/DC converter  - evaluate the performance of the PEM fuel cell with fixed loads, with DC/DC converter  - measurement of the current/voltage characteristic curve of the PEM fuel cell with variable load  - determination of the of the energy efficiency of the PEM fuel cell |  | | | |  | | | |  | | | |
| 3.7.3 | It must include the following components (not limited to):   * lead acid electrical accumulator(s), 12V, 7.2Ah * acquisition and data analysis software * vertical supporting frame for boards/modules, including:   + reversible storage of pure hydrogen according to the technique of metal hydrides with:     - capacity: 18.9 g (0.212 Nm3) of hydrogen     - metal hydride alloy: AB2 model     - volume of the entire system: 0.5 litres     - max working pressure: 30 bar     - H2 maximum pressure for charging: < 30 bar (static)     - stainless steel pressure vessels certified to TPED (directive 2010/35/EU) with: a filled alloy metal (hydrogen storage alloy: AB model) and an integrated sintered metal filter     - stop valve or quick-action valve   + a PEM fuel cell with a power of minimum 100W including the electronic controller, complete with sensors (pressure, flow, and temperature) for measurement and acquisition   + a measurement instruments, containing 2 displays for voltage/current/power (DC voltmeter: max 32V, DC ammeter: max 20A, and power meter: max 1000W) and 2 displays for pressure, flow, and temperature   … |  | | | |  | | | |  | | | |
| 3.7.3 | …   * + DC/DC converter (step down or “buck” converter) with output 12V, 8A   + a load consisting of lamps, one halogen (12V, 20W min.) and one LED (12V, 3x1W min.)   + a variable logarithmic rheostat, from 1.5 Ω to about 17 Ω, 8A max current and 100W max power |  | | | |  | | | |  | | | |
| 3.7.4 | User manual, covering theoretical and practical topics must be in English language |  | | | |  | | | |  | | | |
| **3.8** | **HYDROGEN GENERATOR FOR THE SYSTEM TRAINERS** |  | | | |  | | | |  | | | |
|  | Quantity: 2 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.8.1 | To be used with item 3.7 for generating hydrogen for laboratory use.  Hydrogen must be generated through water electrolysis and the main component of the generator must be an electrochemical cell assembly with a solid polymer electrolyte filled by deionized or pure distilled water.  The generator must comply with the specifications for a class B digital device, part 15 of the FCC rules. |  | | | |  | | | |  | | | |
| 3.8.2 | - hydrogen flowrates: approx. 0 ÷ 100cc/min at STP  - max. outlet pressure: min. 10bar  - purity: 99.9999%  - power consumption: max. 150W  - pressure accuracy: ± 0.5%  - display controlled by microprocessor: graphic display  - operating temperature: 15°C to 40°C  - operating non-condensing relative humidity: 0 ÷ 80%  - over-voltage category: II  - level of noise: max. 50dB  - degree of pollution: 2 |  | | | |  | | | |  | | | |
| 3.8.3 | User manual must be in English language including comprehensive chapters about safety, installation and initial startup, rinse air bubble, quick start, and maintenance |  | | | |  | | | |  | | | |
| **3.9** | **SOLAR PHOTOVOLTAIC AND THERMAL SYSTEM SIMULATOR** | |  | | | |  | | | |  | | | |
|  | Quantity: 1 | |  | | | |  | | | |  | | | |
|  | Manufacturer: | |  | | | |  | | | |  | | | |
|  | Brand/Model: | |  | | | |  | | | |  | | | |
|  | Origin: | |  | | | |  | | | |  | | | |
| 3.9.1 | This system simulator must be used as a basic training system to learn and familiarize about photovoltaic and thermal systems and their behaviour under different operating conditions.  The system simulator must be monitored directly or through a PC by teacher and students with the possibility to introduce faults using the PC and proceed with troubleshooting activities by the students using the system simulator itself.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. | |  | | | |  | | | |  | | | |
| 3.9.2 | Following experiences/experiments must be possible (not limited to):  - simulation of different values of the solar irradiance (W/m2) and of the temperature of the photovoltaic cells  - change of the electrical load  - tracing of the V-I and of the V-P characteristics based on the solar irradiance and the temperature of the cells  - conversion efficiency of the photovoltaic cells  - simulation of different values of the solar irradiance (W/m2) and of the temperature of the liquid at thermal panel’s inlet  - change of the capacity of the liquid through the thermal panel  - temperature of the liquid at the thermal panel’s outlet, based on the solar irradiance and the inlet temperature  - conversion efficiency of the thermal panel | |  | | | |  | | | |  | | | |
| 3.9.3 | It must include the following parts (not limited to):   * 1 single crystalline silicon photovoltaic cell, minimum side 125 mm * 2 photovoltaic cells with series connection * 2 photovoltaic cells with parallel connection * 1 module with 36 photovoltaic cells series with series connection * 1 thermal panel * 1 panel to control and monitor the operating conditions * interface(s) for connection to an external PC * software to manage externally operating conditions and to constantly monitor the behaviour of the photovoltaic and thermal components displaying data | |  | | | |  | | | |  | | | |
| 3.9.4 | User manual and software, covering theoretical and practical topics must be in English language | |  | | | |  | | | |  | | | |
| **3.10** | **SOLAR THERMAL HOME SYSTEM SIMULATOR** | | |  | | | |  | | | |  | | | |
|  | Quantity: 1 | | |  | | | |  | | | |  | | | |
|  | Manufacturer: | | |  | | | |  | | | |  | | | |
|  | Brand/Model: | | |  | | | |  | | | |  | | | |
|  | Origin: | | |  | | | |  | | | |  | | | |
| 3.10.1 | This system simulator must be used as a basic training system about theoretical study of solar plants that may be used to produce hot water for sanitary and air conditioning purposes or other civil applications.  The system simulator must be controlled and monitored through a PC by teacher and students with the possibility to introduce faults and proceed with troubleshooting activities.  All components must be safe, easy to manage, with a self-explanatory schematic diagram to allow easy operativity. | | |  | | | |  | | | |  | | | |
| 3.10.2 | Following experiences/experiments must be possible (not limited to):  - types of solar thermal systems  - components, circuits and connections identification and analysis  - analysis of the technical parameters for all the components of the system  - criteria for dimensioning a sanitary hot water plant  - criteria for assembly and maintenance  - interpretation of data | | |  | | | |  | | | |  | | | |
| 3.10.3 | It must include the following parts (not limited to):   * a part that represents how the liquid that comes from the solar thermal module heats the water in the storage reservoir * a part that represents the solar thermal module, complete with probes to detect the temperature of the inlet (hot) and outlet (cold) liquid and a light sensor to detect the solar irradiance * a part reproducing an application of the obtained hot water * interface(s) for connection to an external PC * software to manage externally operating conditions and to constantly monitor the behaviour of the simulator | | |  | | | |  | | | |  | | | |
| 3.10.4 | - Hydraulic circuit must include the following simulated components (not limited to):  cold water inlet, DHW (Domestic Hot Water) and return, boiler support or resistance, exchanger support, solar circuit heat exchanger, magnesium anode, steel tank, insulating layer, external coating, solar flat collector, solar circuit loading/unloading valve, flow regulator, air release valve, safety valve, manometer, thermometer, check valve, expansion tank, solar circuit pump, DHW pump, pump circuit support, and radiator heating circuit  - Electric circuit must include the following simulated components (not limited to):  control unit, solar circuit pump, DHW pump, pump circuit support, collector sensor hot side, collector sensor cold side, tank sensor hot side, tank sensor cold side, DHW return sensor, cold water inlet sensor, flowmeter, solar radiation sensor, and aerotherm  - thermal collector must include the following simulated components (not limited to):  glass, absorber, pipes, frame, and insulator | | | |  | | | |  | | | |  | | | |
| 3.10.5 | User manual and software, covering theoretical and practical topics must be in English language | | |  | | | |  | | | |  | | | |
| **3.11** | **PERSONAL COMPUTER** |  | | | |  | | | |  | | | |
|  | Quantity: 8 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.11.1 | To be used with items from 3.1 to 3.5, 3.7, 3.9 and 3.10 and relevant software supplied  Able to manage modern office suite software |  | | | |  | | | |  | | | |
| 3.11.2 | Brand-name Personal Computer  Processor: Intel Core i5 or AMD Ryzen 5  OS: Microsoft Windows 10/11 Home  Memory: 8 GB of RAM  Storage: 240 GB SSD or larger  Monitor: 14″ – 17″ wide screen display  Network: 802.11ac (or better) Wi-Fi capability  USB Ports: 2  Keyboard: English layout (Egyptian Arabic layout is also recommended) |  | | | |  | | | |  | | | |
| 3.11.3 | User manual must be in English language |  | | | |  | | | |  | | | |
| **3.12** | **CHAIR FOR STUDENT** |  | | | |  | | | |  | | | |
|  | Quantity: 16 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.12.1 | • Ergonomic seat  • Rigid Base frame  • Stackable with one another and on tables  • Carry handle in backrest  • Prevents tiring  • Robust and stable  • Easy to clean  • plastic glides to protect floors  • Cylindrical tubing legs, 2.5mm at least  • Height of seat, 46cm |  | | | |  | | | |  | | | |
| **3.13** | **WORKBENCH** |  | | | |  | | | |  | | | |
|  | Quantity: 8 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.13.1 | Large sized bilaminate wooden table and sturdy legs with compensation feet  Dimensions: 200 x 100 x 80 cm (LxWxH) |  | | | |  | | | |  | | | |
| **3.14** | **PERSONAL COMPUTER FOR TEACHER/TRAINER** |  | | | |  | | | |  | | | |
|  | Quantity: 1 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.14.1 | To be used with items from 3.1 to 3.5, 3.7, 3.9 and 3.10 and relevant software supplied  Able to manage modern office suite software |  | | | |  | | | |  | | | |
| 3.14.2 | Brand-name All-In-One Personal Computer  Processor: Intel Core i5 or AMD Ryzen 5  OS: Microsoft Windows 10/11 Home  Memory: 16 GB of RAM  Storage: 500 GB SSD or larger  Monitor: min 23″ screen display  Network: 802.11ac (or better) Wi-Fi capability  USB Ports: 2  HDMI Port  Webcam  Wired Optical Mouse  Keyboard: English layout (Egyptian Arabic layout is also recommended) |  | | | |  | | | |  | | | |
| 3.14.3 | User manual must be in English language |  | | | |  | | | |  | | | |
| **3.15** | **INTERACTIVE WHITEBOARD** |  | | | |  | | | |  | | | |
|  | Quantity: 1 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.15.2 | Brand-name Interactive Whiteboard  Diagonal Size: 65”  Panel resolution: 3840 x 2160 (Landscape)  Touchscreen  Touch Pen Type: passive pen with magnet  Connectivity input video: 2 HDMI  Connectivity input USB: 2  Connectivity output external: RS232C, LAN, WiFi/BT  Power Supply: AC 100~240V 50/60Hz. |  | | | |  | | | |  | | | |
| 3.15.3 | User manual must be in English language |  | | | |  | | | |  | | | |
| **3.16** | **CHAIR FOR TEACHER/TRAINER** |  | | | |  | | | |  | | | |
|  | Quantity: 1 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.16.1 | • Swivel chair with armrests  • Cushioned seat and backrest  • Gas lift height adjustment  • Circular footrest with casters  • Mechanism for adjusting height and inclination of backrest |  | | | |  | | | |  | | | |
| **3.17** | **DESK FOR TEACHER/TRAINER** |  | | | |  | | | |  | | | |
|  | Quantity: 1 |  | | | |  | | | |  | | | |
|  | Manufacturer: |  | | | |  | | | |  | | | |
|  | Brand/Model: |  | | | |  | | | |  | | | |
|  | Origin: |  | | | |  | | | |  | | | |
| 3.17.1 | Top highly compressed multi-layered fine chipboard covered with plastic laminate and sturdy legs with compensation feet  Chest with 2 drawers with stop and key lock  Dimensions: cm 140 x 70 x 80 (LxWxH) |  | | | |  | | | |  | | | |

**LOT 4: TRAINING EQUIPMENT AND TEACHWARE FOR MULTIMEDIA CLASSROOM**

| **1.**  **Item number** | **2.**  **Specifications required** | **3.**  **Specifications offered** | **4.**  **Notes, remarks,  ref to documentation** | **5.**  **Evaluation committee’s notes** | |
| --- | --- | --- | --- | --- | --- |
| **4.1** | **MULTIMEDIA TEACHWARE PACKAGE ABOUT PROCESS CONTROL TECHNIQUES** |  |  |  | |
|  | Quantity: 10 simultaneously usable stations |  |  |  | |
|  | Manufacturer: |  |  |  | |
|  | Brand/Model: |  |  |  | |
|  | Origin: |  |  |  | |
| 4.1.1 | This multimedia teachware package must be designed to allow the learner to study theoretically and practically (in a simulated 3d ambient) how to manage a process control system from the basic theory to real (simulated) application(s).  The learner must have the possibility to access learning topics, with theory, instructions, and experiment proposals according to the learning path created and his personal learning speed with or without the control of a teacher.  The learner must have the possibility to check activities he completed before moving to the next ones.  It must be modular and easily completed/combined with other multimedia teachware of the same nature covering different topics/subjects for future improvement.  It must have a comprehensive online/offline help/tutorial(s) so that the instructions on how to use it are clear and easy to understand.  It must be in English language (Italian and Arabic language are also recommended) |  |  |  | |
| 4.1.2 | The multimedia teachware package must allow the student to study the dynamic behaviour, instrumentation aspects and control at least of the main four topics in process industry: level, temperature, flow, and pressure.  Every component simulated inside the 3D ambient should have a dynamic behaviour just like real ones thus, the learner may have a realistic idea of what happen in a real application.  Beside theory, it must allow the student to assemble experiments by dragging and dropping modules to a rack, then connect the wires between these modules and the process plant devices, then perform the experiment itself by simulating the process in real time, by providing excitations and/or disturbances to the process, then measuring results and finding out the suitable parameters for the signal conditioning modules, drivers and/or control modules, depending on the experiment requirements and specifications. |  |  |  | |
| 4.1.3 | The 3D simulated ambient must consist of the following components (not limited to):   * process tank * sump tank with pipelines * valves of different types * DC voltage sources * voltmeters * On/Off controller with or without hysteresis * PID controller with Reset pushbutton * flow transducer * pressure transducer   … |  |  |  | |
| 4.1.3 | …   * level transducer, * temperature transducer * sol valve driver * motor valve driver * pump driver * heater driver * oscilloscope |  |  |  | |
| 4.1.4 | The 3D simulated ambient must allow the learner to perform the wiring, including the wiring between power supply, drivers, sensors, transducers, controllers, voltmeters, oscilloscope used in each experiment, and the main module itself.  The process should be monitored and controlled using a built-in modules, through a free virtual PLC available on internet or through an external real industrial PLC.  It must provide minimum 25 different experiences/experiments about level control, flow control, temperature control, level control using pressure sensor(s), and control with PLC (TIA Portal or Codesys) |  |  |  | |
| 4.1.5 | User manual, covering theoretical and practical topics must be in English language (Italian and Arabic language are also recommended). |  |  |  | |
| **4.2** | **MULTIMEDIA TEACHWARE PACKAGE ABOUT ELECTRIC MACHINES** |  |  |  | |
|  | Quantity: 10 simultaneously usable stations |  |  |  | |
|  | Manufacturer: |  |  |  | |
|  | Brand/Model: |  |  |  | |
|  | Origin: |  |  |  | |
| 4.2.1 | This multimedia teachware package must be designed to allow the learner to study theoretically and practically (in a simulated 3d ambient) how to manage electric machines from the basic theory to real (simulated) application(s).  The learner must have the possibility to access learning topics, with theory, instructions, and experiment proposals according to the learning path created and his personal learning speed with or without the control of a teacher.  The learner must have the possibility to check activities he completed before moving to the next ones.  It must be modular and easily completed/combined with other multimedia teachware of the same nature covering different topics/subjects for future improvement.  It must have a comprehensive online/offline help/tutorial(s) so that the instructions on how to use it are clear and easy to understand.  It must be in English language (Italian and Arabic languages are also recommended) |  |  |  | |
| 4.2.2 | The multimedia teachware package must allow the student to study at least the 6 most important topics about electric machines: general characteristics and basic concepts, induction motors, direct current motors, commutator motors for alternating currents, synchronous machines, and direct current generators.  Every component simulated inside the 3D ambient should have a dynamic behavior just like real ones thus, the learner may have a realistic idea of what happen in a real application.  Beside theory, it must allow the student to assemble experiments by dragging and dropping modules to a rack, then connect the wires between power supplies and the electric motor, brake, sensors and/or other devices used in each experiment, the connections on the electric motor itself, and the connections between the devices and the measurement modules. |  |  | |  | |
| 4.2.3 | The 3D simulated ambient must consist of the following components (not limited to):   * electric machines including all the components (rotors, stators, brakes, load cells, coupling joints, speed transducers, blocks, brushes, supports, … * AC three-phase source * AC single-phase source * DC source * Wattmeters * Speed Meter * Torque Meter * Amperemeters * Voltmeters * Starting Rheostat with Resistive Load * Pole Changing Unit * Excitation Rheostat with Capacitive Load * Rotating light synchronoscope * Pole changing unit * Star/Delta starter * Starting rheostat and synchronizer * Oscilloscope |  |  |  | |
| 4.2.4 | The 3D simulated ambient must allow the learner to perform the wiring, including the wiring between power supplies and the other devices/instruments used in each experiment, and the main module itself.  It must provide minimum 40 different experiences/experiments about basics concepts and theory regarding electric machine, induction motors, direct current motors, commutator motors for alternating current, synchronous machines, direct current generators. |  |  |  | |
| 4.2.5 | User manual, covering theoretical and practical topics must be in English language (Italian and Arabic language are also recommended). |  |  |  | |
| **4.3** | **MULTIMEDIA TEACHWARE PACKAGE ABOUT CIVIL ELECTRICAL INSTALLATIONS** |  |  |  | |
|  | Quantity: 10 simultaneously usable stations |  |  |  | |
|  | Manufacturer: |  |  |  | |
|  | Brand/Model: |  |  |  | |
|  | Origin: |  |  |  | |
| 4.3.1 | This multimedia teachware package must be designed to allow the learner to study theoretically and practically (in a simulated 3d ambient) how to manage civil electrical installations from the basic theory to real (simulated) application(s).  The learner must have the possibility to access learning topics, with theory, instructions, and experiment proposals according to the learning path created and his personal learning speed with or without the control of a teacher.  The learner must have the possibility to check activities he completed before moving to the next ones.  It must be modular and easily completed/combined with other multimedia teachware of the same nature covering different topics/subjects for future improvement.  It must have a comprehensive online/offline help/tutorial(s) so that the instructions on how to use it are clear and easy to understand.  It must be in English language (Italian and Arabic languages are also recommended) |  |  |  | |
| 4.3.2 | The multimedia teachware package must allow the student to study at least the 8 most common topics about civil electric installations: lighting and signaling installations, house phone signaling systems, hotels systems, hospitals systems, firefight protection systems, anti-intrusion installations, and video and house phoning systems.  Every component simulated inside the 3D ambient should have a dynamic behavior just like real ones thus, the learner may have a realistic idea of what happen in a real application.  Beside theory, it must allow the student to assemble experiments by dragging and dropping modules to a rack, then connect the wires between power supplies and the other devices used in each experiment, then perform the experiment itself by simulating the process in real time, by interacting with the system’s components and observing the results. |  |  |  | |
| 4.3.3 | The 3D simulated ambient must consist of the following components (not limited to):   * power supplies * lamps * relays * switches * sensors * push buttons * control units * signalling devices   … |  |  |  | |
| 4.3.3 | …   * phones * transformers * sockets * fans * dummies (to simulate movement and activate sensors) |  |  |  | |
| 4.3.4 | The 3D simulated ambient must allow the learner to perform the wiring, including the wiring between power supplies and the other devices/instruments used in each experiment, and the main module itself.  It must provide minimum 40 different experiences/experiments about basics concepts and theory regarding civil electrical installations lighting and signaling installations, house phone signaling systems, hotels systems, hospitals systems, firefight protection systems, anti-intrusion installations, and video and house phoning systems. |  |  |  | |
| 4.3.5 | User manual, covering theoretical and practical topics must be in English language (Italian and Arabic language are also recommended). |  |  |  | |
| **4.4** | **MULTIMEDIA TEACHWARE PACKAGE ABOUT INDUSTRIAL ELECTRICAL APPLICATIONS** |  |  |  | |
|  | Quantity: 10 simultaneously usable stations |  |  |  | |
|  | Manufacturer: |  |  |  | |
|  | Brand/Model: |  |  |  | |
|  | Origin: |  |  |  | |
| 4.4.1 | This multimedia teachware package must be designed to allow the learner to study theoretically and practically (in a simulated 3d ambient) how to manage industrial electrical installations from the basic theory to real (simulated) application(s).  The learner must have the possibility to access learning topics, with theory, instructions, and experiment proposals according to the learning path created and his personal learning speed with or without the control of a teacher.  The learner must have the possibility to check activities he completed before moving to the next ones.  It must be modular and easily completed/combined with other multimedia teachware of the same nature covering different topics/subjects for future improvement.  It must have a comprehensive online/offline help/tutorial(s) so that the instructions on how to use it are clear and easy to understand.  It must be in English language (Italian and Arabic languages are also recommended) |  |  |  | |
| 4.4.2 | The multimedia teachware package must allow the student to study at least the 6 most common topics about industrial electric installations: basic and advanced installations, basic and advanced motor starting, motor starting with sensors, motor starting and control with PLC (Codesys and TIA Portal) and, motor starting and control with VSD.  Every component simulated inside the 3D ambient should have a dynamic behavior just like real ones thus, the learner may have a realistic idea of what happen in a real application.  Beside theory, it must allow the student to assemble experiments by dragging and dropping modules to a rack, then connect the wires between power supplies and the other devices used in each experiment, then perform the experiment itself by simulating the process in real time, by interacting with the system’s components and observing the results. |  |  |  | |
| 4.4.3 | The 3D simulated ambient must consist of the following components (not limited to):   * power supplies * toggle buttons * relays * switches * sensors * push buttons * contactors * starters   … |  |  |  | |
| 4.4.3 | …   * motors * transformers * VFD * PLC(s) |  |  |  | |
| 4.4.4 | The 3D simulated ambient must allow the learner to perform the wiring, including the wiring between power supplies and the other devices/instruments used in each experiment, and the main module itself.  It must provide minimum 40 different experiences/experiments about basics concepts and theory about industrial electrical installations, basic and advanced installations, basic and advanced motor starting, motor starting with sensors, motor starting and control with PLC (Codesys and TIA Portal) and, motor starting and control with VSD. |  |  |  | |
| 4.4.5 | User manual, covering theoretical and practical topics must be in English language (Italian and Arabic language are also recommended). |  |  |  | |
| **4.5** | **MULTIMEDIA TEACHWARE PACKAGE ABOUT INDUSTRIAL ROBOTICS** |  |  |  | |
|  | Quantity: 10 simultaneously usable stations |  |  |  | |
|  | Manufacturer: |  |  |  | |
|  | Brand/Model: |  |  |  | |
|  | Origin: |  |  |  | |
| 4.5.1 | This multimedia teachware package must be designed to allow the learner to study theoretically and practically (in a simulated 3d ambient) about industrial robotics from the basic theory to real (simulated) application(s).  The learner must have the possibility to access learning topics, with theory, instructions, and experiment proposals according to the learning path created and his personal learning speed with or without the control of a teacher.  The learner must have the possibility to check activities he completed before moving to the next ones.  It must be modular and easily completed/combined with other multimedia teachware of the same nature covering different topics/subjects for future improvement.  It must have a comprehensive online/offline help/tutorial(s) so that the instructions on how to use it are clear and easy to understand.  It must be in English language (Italian and Arabic languages are also recommended) |  |  |  | |
| 4.5.2 | The multimedia teachware package must allow the student to study at least the most common topics related to industrial robotics (SCARA and palletizer robots): basic theory about robotics, direct and inverse kinematics, trajectory planning and control using GCode, CNC, Denavit-Hartenberg notation, and robot dynamics.  Every component simulated inside the 3D ambient should have a dynamic behavior just like real ones thus, the learner may have a realistic idea of what happen in a real application.  Beside theory, it must allow the student to assemble experiments by dragging and dropping modules to a rack, then connect the wires between power supplies and the other devices used in each experiment, then perform the experiment itself by simulating the process in real time, by interacting with the system’s components and observing the results. |  |  |  | |
| 4.5.3 | The 3D simulated ambient must consist of the following components (not limited to):   * SCARA robot(s) * Palletizer robot(s) * Virtual equipment controllable via CODESYS control * Space where movements are simulated and other parts |  |  |  | |
| 4.5.4 | The 3D simulated ambient must allow the learner to perform complex projects as sequence of smaller and simpler activities that the learner may complete step by step.  It must provide different experiences/experiments about basics concepts and theory regarding industrial robotics, direct and inverse kinematics, trajectory planning and control using GCode, CNC, Denavit-Hartenberg notation, and robot dynamics. |  |  |  | |
| 4.5.5 | User manual, covering theoretical and practical topics must be in English language (Italian and Arabic language are also recommended). |  |  |  | |
| **4.6** | **MULTIMEDIA TEACHWARE PACKAGE ABOUT FACTORY DESIGN AND AUTOMATION** |  |  |  | |
|  | Quantity: 10 simultaneously usable stations |  |  |  | |
|  | Manufacturer: |  |  |  | |
|  | Brand/Model: |  |  |  | |
|  | Origin: |  |  |  | |
| 4.6.1 | This multimedia teachware package must be designed to allow the learner to understand theoretically and practically (in a simulated 3d ambient) the main concepts about industrial automation and PLC programming in modern factories.  The learner must have the possibility to access learning topics, with theory, instructions, and experiment proposals according to the learning path created and his personal learning speed with or without the control of a teacher.  The learner must have the possibility to check activities he completed before moving to the next ones.  It must be modular and easily completed/combined with other multimedia teachware of the same nature covering different topics/subjects for future improvement.  It must have a comprehensive online/offline help/tutorial(s) so that the instructions on how to use it are clear and easy to understand.  It must be in English language (Italian and Arabic languages are also recommended) |  |  |  | |
| 4.6.2 | The multimedia teachware package must allow the learner to practice about the topics related to industrial automation through the creation of a simulated industrial production line, with equipment, sensors, and actuators, and control it using a PLC or a SoftPLC.  Every component simulated inside the 3D ambient should have a dynamic behaviour just like real ones thus, the learner may have a realistic idea of what happen in a real application.  Beside theory, it must allow the student to assemble experiments by dragging and dropping modules to a rack, then connect the wires between power supplies and the other devices used in each experiment, then perform the experiment itself by simulating the process in real time, by interacting with the system’s components and observing the results. |  |  |  | |
| 4.6.3 | The 3D simulated ambient must consist of the following components (not limited to):   * machines * conveyors (belt, rolls, with scale, weight) * elevators * robots * ink printers * sensors   … |  |  |  | |
| 4.6.3 | …   * actuators * chute system(s) with pistons * pick-and-place and palletizer devices * PLC or SoftPLC * space where build the production line and other parts |  |  |  | |
| 4.6.4 | The 3D simulated ambient must allow the learner to simulate disconnection and defects in every sensor, actuator, and other problem with the moved parts and to monitor the status, force values in actuators or sensors, or command actuators with the possibility to force sensors and actuators signals on or off, as well as release it.  It must provide different experiences/experiments about basics concepts and theory regarding industrial automation, design and implementation of production lines including equipment, sensors, actuators, conveyor systems, development of PLC projects for production line equipment, development of PLC projects for material flow management, automation basics, PLC, sensors and actuators, automation strategies such as state machines,  interlocks, control strategies and advanced control, robotics basic, basic and advanced PLC programming. |  |  |  | |
| 4.6.5 | User manual, covering theoretical and practical topics must be in English language (Italian and Arabic language are also recommended). |  |  |  | |
| **4.7** | **MULTIMEDIA TEACHWARE PACKAGE ABOUT SCADA SYSTEM IN AUTOMATION** |  |  |  | |
|  | Quantity: 10 simultaneously usable stations |  |  |  | |
|  | Manufacturer: |  |  |  | |
|  | Brand/Model: |  |  |  | |
|  | Origin: |  |  |  | |
| 4.7.1 | This multimedia teachware package must be designed to allow the learner to understand theoretically and practically (in a simulated 3d ambient) the main concepts about common SCADA system for automated machines and processes existing in the market.  The learner must have the possibility to access learning topics, with theory, instructions, and experiment proposals according to the learning path created and his personal learning speed with or without the control of a teacher.  The learner must have the possibility to check activities he completed before moving to the next ones.  It must be modular and easily completed/combined with other multimedia teachware of the same nature covering different topics/subjects for future improvement.  It must have a comprehensive online/offline help/tutorial(s) so that the instructions on how to use it are clear and easy to understand.  It must be in English language (Italian and Arabic languages are also recommended) |  |  |  | |
| 4.7.2 | The multimedia teachware package must allow the learner to practice about the topics related to supervisory control systems to be able to develop SCADA systems for automatic machines and processes with resources such as synoptics, alarm summary, trends and so on, along with the ability to create scripts for SCADA systems for implementing features that are not provided natively by the platform.  The learner will be able to learn the main topics, the hardware and software components, the interaction to controllers and other systems, the communication drivers and OPC servers, the programming environment and tools, the user interface components, the real-time databases, the user management, the development of projects understanding its requirements, defining its architecture, and then testing and validating it.  The SCADA system must be ready to work with the last technology common tools such as Codesys visualization, Elipse E3, and Siemens WinCC or similar industrial platform for real-time information management. |  |  |  | |
| 4.7.3 | The 3D simulated ambient must permit to develop the following activities (not limited to):   * process using the SCADA system Codesys VISU, understanding many tasks such as building application objects, implementing charts/trends/alarm summary   … |  |  |  | |
| 4.7.3 | …   * process using the SCADA system Elipse E3, building a control room for the operation of all its processes and machines, and understanding OPC communication, Elipse E3 environment, and implementing synoptic/main interface * process using the SCADA system Elipse E3 to enhance operation and security of the process, and understanding how to optimize/save tags, and how to implement recipe management * process using the SCADA system WinCC, understanding the WinCC basics, implementing visualizations/operation features/charts and trends/user management/alarms and alerts * dosing and mixing using the SCADA system |  |  |  | |
| 4.7.4 | User manual, covering theoretical and practical topics must be in English language (Italian and Arabic language are also recommended). |  |  |  | |
| **4.8** | **PERSONAL COMPUTER** |  |  |  | |
|  | Quantity: 10 |  |  |  | |
|  | Manufacturer: |  |  |  | |
|  | Brand/Model: |  |  |  | |
|  | Origin: |  |  |  | |
| 4.8.1 | To be used with items from 4.1 to 4.7 and relevant software supplied  Able to manage modern office suite software |  |  |  | |
| 4.8.2 | Brand-name All-In-One Personal Computer  Processor: Intel Core i7 or AMD Ryzen 7  OS: Microsoft Windows 10/11 Pro  Memory: 16 GB of RAM  Storage: 500 GB SSD or larger  Graphic card: dedicated graphic card with at least 4GB, GDDR5  Monitor: min 23″ screen display  Network: 802.11ac (or better) Wi-Fi capability  Webcam 720p  Wired stereo headphones  USB Ports: 2  HDMI Port  Wired Optical Mouse  Keyboard: English layout (Egyptian Arabic layout is also recommended) |  |  |  | |
| 4.8.3 | User manual must be in English language |  |  |  | |
| **4.9** | **CHAIR FOR LEARNER** |  |  |  | |
|  | Quantity: 10 |  |  |  | |
|  | Manufacturer: |  |  |  | |
|  | Brand/Model: |  |  |  | |
|  | Origin: |  |  |  | |
| 4.9.1 | • Ergonomic seat  • Rigid Base frame  • Stackable with one another and on tables  • Carry handle in backrest  • Prevents tiring  • Robust and stable  • Easy to clean  • plastic glides to protect floors  • Cylindrical tubing legs, 2.5mm at least  • Height of seat, 46cm |  |  |  | |
| **4.10** | **WORK BENCH** |  |  |  | |
|  | Quantity: 5 |  |  |  | |
|  | Manufacturer: |  |  |  | |
|  | Brand/Model: |  |  |  | |
|  | Origin: |  |  |  | |
| 4.10.1 | Large sized bilaminate wooden table and sturdy legs with compensation feet  Dimensions: 200 x 100 x 80 cm (LxWxH) |  |  |  | |

**LOT 5: MISCELLANEOUS EQUIPMENT AND MACHINERIES** **FOR LABS AND WORKSHOPS**

| **1.**  **Item number** | **2.**  **Specifications required** | **3.**  **Specifications offered** | **4.**  **Notes, remarks,  ref to documentation** | **5.**  **Evaluation committee’s notes** |
| --- | --- | --- | --- | --- |
| **5.1** | **FIRST AID INSTRUCTOR KIT** |  |  |  |
|  | Quantity: 2 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 5.1.1 | Kit with manikins to deliver training for up to 12 persons, 3 AED trainers, choking vest and various other items including gloves, dressings, and a BSI First Aid Kit. |  |  |  |
| 5.1.2 | Not for paediatric First Aid Training. |  |  |  |
| 5.1.3 | Features:   * latex free * interchangeable adult/child settings * audible clicker during CPR * easy clean skin ideal for AED training pads |  |  |  |
| 5.1.4 | AED trainers:   * 1 cellAED * 2 universal |  |  |  |
| 5.1.5 | User manual must be in English language (Italian and Arabic language are also recommended). |  |  |  |
| **5.2** | **FIRST AID AT WORK COURSES INSTRUCTOR KIT** |  |  |  |
|  | Quantity: 10 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 5.2.1 | kit with a range of items that are needed to teach first aid at work courses in a holdall bag with compartments for easy access. |  |  |  |
| 5.2.2 | Content of the kit (not limited to):   * 2 Resus Aid with Valve * 12 Resus Face Shield with Filter Paper * 1 Resus Aid in Keyring Pouch   - 1 Box of Alcohol-Free Wipes  - 1 PRO BSI Small First Aid Kit (Complete)  - 1 Accident Book  - 3 Boxes of Large Nitrile Gloves  - 1 Box of Medium Nitrile Gloves  - 10 Crepe Bandages  - 1 Cellular Blanket  - 4 Foil Blankets  - 5 Biohazard Bags  - 1 Biohazard Kit  - 6 Instant Ice Packs  - 1 Le Mans Bag  - 1 Bottle of Eye solution  - 1 Strip of 5 Eye Wash Pods  - 1 Sharps Bin 0.6 Litre  - 1 Box of 100 mixed Fabric Plasters  - 6 Micropore Tapes 2.5cm x 10m  - 10 Finger Dressings  - 3 CPR Facemasks in Box  - 20 Cotton Calico Triangular Bandages  - 6 Tweezers  - 6 Tuffcut Scissors  - 20 Eye Pad Dressings  - 50 Medium Dressings |  |  |  |
| 5.2.3 | User manual, covering theoretical and practical topics must be in English language (Italian and Arabic language are also recommended). |  |  |  |
| **5.3** | **IPAD AED TRAINER** |  |  |  |
|  | Quantity: 2 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 5.3.1 | Lightweight training unit to provide people with a way to learn how to use an AED in a training environment. |  |  |  |
| 5.3.2 | Not for use in real-life situations |  |  |  |
| 5.3.3 | Unit with:   * 8 different training scenarios * infrared remote control |  |  |  |
| 5.3.4 | User manual must be in English language (Italian and Arabic language are also recommended). |  |  |  |
| **5.4** | **PERSONAL PROTECTIVE EQUIPMENT TRAINING KIT** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 5.4.1 | Multimedia software for training people about PPE as one method to minimize a workers exposure to hazards and their appropriate use at work.  Referring to OSHA or European standards. |  |  |  |
| 5.4.2 | Arranged in a 3 steps training proposal: 1- classroom/online training  2- field training  3- evaluation |  |  |  |
| 5.4.3 | Topics covered (not limited to): - general PPE information  - Personal Protective Equipment types (head, eye and face, hearing, respiratory, …, protection)  - proper use of PPE  - care and maintenance of PPE |  |  |  |
| 5.4.4 | User manual must be in English language (Italian and Arabic language are also recommended). |  |  |  |
| **5.5** | **PLASMA MACHINE** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 5.5.1 | Cut capacity:  20mm thickness, 450 mm/min 25mm thickness, 220 mm/min |  |  |  |
| 5.5.2 | Input voltage:  200–480 V, 1-PH, 50/60 Hz  200–600 V, 3-PH, 50/60 Hz  Output:  9 KW (power)  20-65 A (current) |  |  |  |
| 5.5.3 | Gas supply:  clean, dry, oil-free air or nitrogen  7.6–8.3 bar (inlet gas pressure)  5.2 bar (minimum inlet gas pressure) |  |  |  |
| 5.5.4 | Power supply type: Inverter |  |  |  |
| 5.5.5 | User manual must be in English language (Italian and Arabic language are also recommended). |  |  |  |
| **5.6** | **HANDHELD WELDING QUALITY MANAGEMENT SYSTEM** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 5.6.1 | Kit with handheld laser-based wireless system for welding inspection including battery(ies), charger(s), cables, and accessories as required for properly operate the system supplied in a blow case |  |  |  |
| 5.6.2 | Features required:  - non-contact electronic inspection of joints and welds  - laser Class - II M  - simple intuitive icon-based interface  - immediate measurement results  - encoder measurement module for reliable data collection on long welds  - able to creates inspection reports  - ability to transfer inspection results over Wi-Fi or USB  - minimum battery life 3 hrs  - able to take picture of the joint and/or weld for documentation  - ability to illuminate the weld area for easier weld observation |  |  |  |
| 5.6.3 | User manual must be in English language (Italian and Arabic language are also recommended). |  |  |  |
| **5.7** | **3D MEASUREMENT ARM** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 5.7.1 | Three-dimensional portable digitizer for industry application including cables, software, tools, and accessories as required for properly operate the system supplied in a blow case |  |  |  |
| 5.7.2 | Including (not limited to):   * Certificate of Calibration * USB cable   - Two 5mm ruby ball probe tips, one 3mm ruby ball tip and one point probe tip (Metrology set)  - Tip calibration fixture  - Tip tool  - Hand switch |  |  |  |
| 5.7.3 | Features required:  - Reach: 630mm  - Work area (diameter): 1600mm  - Degrees of freedom: 5  - Accuracy: 0.065 mm |  |  |  |
| 5.7.4 | User manual must be in English language (Italian and Arabic language are also recommended). |  |  |  |
| **5.8** | **DOUBLE NEEDLE LOCK STITCH MOVEABLE BAR–ELECTRONIC** |  |  |  |
|  | Quantity: 5 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 5.8.1 | - Servo Motor Direct Drive  - Thread trimmer  To be used for all kind of cotton fabric (knitting -woven - heavy fabrics) |  |  |  |
| 5.8.2 | User manual must be in English language (Italian and Arabic language are also recommended). |  |  |  |
| **5.9** | **AUTOMATIC BUTTONHOLE MACHINE** |  |  |  |
|  | Quantity: 4 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 5.9.1 | - Servo Motor Direct Drive  - Buttonholes lengths from (6mm to 38mm) |  |  |  |
| 5.9.2 | User manual must be in English language (Italian and Arabic language are also recommended). |  |  |  |
| **5.10** | **PERSONAL COMPUTER FOR TEACHER/TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 5.10.1 | To be used with items from 3.1 to 3.5, 3.7, 3.9 and 3.10 and relevant software supplied  Able to manage modern office suite software |  |  |  |
| 5.10.2 | Brand-name All-In-One Personal Computer  Processor: Intel Core i5 or AMD Ryzen 5  OS: Microsoft Windows 10/11 Home  Memory: 16 GB of RAM  Storage: 500 GB SSD or larger  Monitor: min 23″ screen display  Network: 802.11ac (or better) Wi-Fi capability  USB Ports: 2  HDMI Port  Webcam  Wired Optical Mouse  Keyboard: English layout (Egyptian Arabic layout is also recommended) |  |  |  |
| 5.10.3 | User manual must be in English language |  |  |  |
| **5.11** | **INTERACTIVE WHITEBOARD** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 5.11.2 | Brand-name Interactive Whiteboard  Diagonal Size: 65”  Panel resolution: 3840 x 2160 (Landscape)  Touchscreen  Touch Pen Type: passive pen with magnet  Connectivity input video: 2 HDMI  Connectivity input USB: 2  Connectivity output external: RS232C, LAN, WiFi/BT  Power Supply: AC 100~240V 50/60Hz. |  |  |  |
| 5.11.3 | User manual must be in English language |  |  |  |
| **5.12** | **CHAIR FOR TEACHER/TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 5.12.1 | • Swivel chair with armrests  • Cushioned seat and backrest  • Gas lift height adjustment  • Circular footrest with casters  • Mechanism for adjusting height and inclination of backrest |  |  |  |
| **5.13** | **DESK FOR TEACHER/TRAINER** |  |  |  |
|  | Quantity: 1 |  |  |  |
|  | Manufacturer: |  |  |  |
|  | Brand/Model: |  |  |  |
|  | Origin: |  |  |  |
| 5.13.1 | Top highly compressed multi-layered fine chipboard covered with plastic laminate and sturdy legs with compensation feet  Chest with 2 drawers with stop and key lock  Dimensions: cm 140 x 70 x 80 (LxWxH) |  |  |  |