



## **TECHNICAL SPECIFICATIONS**

SOLICITATION Number RSU-07-18

TOTAL ABC: PhP51,043,000.00

TOTAL QTY: 72

### **PROCUREMENT OF TECHNICAL & SCIENTIFIC EQUIPMENT**

- LOT-1:** CNC Milling with Inter Changeable Programmer & CNC Turning Lathe with Inter Changeable Programmer (ABC: PhP8,500,000.00, QTY: 2)
- LOT-2:** Refrigeration & Air conditioning Trainer (ABC: PhP3,500,000.00, QTY: 1)
- LOT-3:** Feed milling Equipment (ABC: PhP1,252,000.00, QTY: 1)
- LOT-4:** Boiler & Steam Jacket Kettle (ABC: PhP4,500,000.00, QTY: 3)
- LOT-5:** Backhoe Excavator, Dump Truck & Portable Concrete Mixer (ABC: PhP6,580,000.00, QTY: 4)
- LOT-6:** Smart Grid (ABC: PhP10,000,000.00, QTY: 1)
- LOT-7:** Electric Machines (ABC: PhP1,500,000.00, QTY: 1)
- LOT-8:** Linear Circuit Lab (1), Linear Circuit Lab (2), and Electrical & Electronic Circuit Lab (ABC: PhP2,750,000.00, QTY: 3)
- LOT-9:** Digital Logic Lab (ABC: PhP800,000.00, QTY: 1)
- LOT-10:** Arduino Trainer (ABC: PhP1,000,000.00, QTY: 1)
- LOT-11:** Raspberry Pi Trainer (ABC: PhP1,000,000.00, QTY: 5)
- LOT-12:** Hydraulic Press (ABC: PhP1,500,000.00, QTY: 1)
- LOT-13:** Sieve Shaker Machine & I. S. Sieve Set (ABC: PhP350,000.00, QTY: 3)
- LOT-14:** Electronic Theodolite (ABC: PhP225,000.00, QTY: 3)
- LOT-15:** Handheld GPS (ABC: PhP270,000.00, QTY: 6)
- LOT-16:** Hydrostatic Bench With Slotted Weight And Tank (ABC: PhP3,955,000.00, QTY: 1)
- LOT-17:** Personal Computer with Accessories & A3 Printer with Print Materials (ABC: PhP483,000.00, QTY: 13)
- LOT-18:** Structural Engineering Learning Center with Multimedia (ABC: PhP1,800,000.00, QTY: 1)
- LOT-19:** LED TV & Digital Camera (ABC: PhP1,078,000.00, QTY: 21)

### **LOT-1: CNC MILLING WITH INTER CHANGEABLE PROGRAMMER & CNC TURNING LATHE WITH INTER CHANGEABLE PROGRAMMER (ABC: PhP51,123,000.00, QTY: 2)**

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<b>CNC milling w/ interchangeable programmer</b> , Work area: travel x/y/z (2000/800/750mm); dist. spindle nose: 0/750mm; no. of axes: 3; motion speed: 50/50/50m/min; clamping area: 2400x750mm; max. Table load: 2200kg; tool change: no. of tool station: 30; max. Tool dia.: 75(125mm) milling spindle: max. Speed: 15000rpm; max. torque: 125n-m;	
unit	<b>CNC turning lathe w/ inter changeable programmer</b> , Work area: travel x/y/z (160/+40/-30/510mm); bar dia.: 45(51mm); Max. Turning dia.: 300mm; swing over bed: 430mm; rapid motion speed in x/y/z: (30m/min/15m/min/45m/min); max. Speed: 7000 rpm max. Power: 15kw; max. Torque: 100n-m counter spindle: max. Speed: 7000rpm; max. Power: 15kw; max. Torque: 100n-m; tailstock: VDI size: 25; no. of tools: 12; driven tools: 12; max. Speed: 6000rpm; max. Power: 4kw; max. torque: 16n-m	



## LOT-2: REFRIGERATION & AIR CONDITIONING TRAINER (ABC: PhP3,500,000.00, QTY: 1)

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<b>REFRIGERATION &amp; AIRCONDITIONING TRAINER</b> , Power input: AC220V; $\pm 10\%$ (50HZ) Bench structure: Aluminum iron Refrigerant: Air conditioning (R22); Refrigeration (R134a) Instrument: digital voltmeter and ammeter Safety: short circuit; overload and leakage protection.	



## LOT-3: FEED MILLING EQUIPMENT (ABC: PhP1,252,000.00, QTY: 1)

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<b>Feed milling equipment</b> , with: 5-tonner hammer mill, diesel engine driven, 18-30hp, fine sieve; flatbed dryer, 50 cavans capacity, rice hull furnace, motorized fan; ribbon mixer, 10 bagger, with conveyor and bagger; bag stitcher; weighing scale, 250 kg capacity.	



## LOT-4: BOILER & STEAM JACKET KETTLE (ABC: PhP4,500,000.00, QTY: 3)

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<b>Boiler</b> , 10 boiler horsepower, diesel fuel burner, vertical fire tubes, complete with safety controls, 4-header, with insulation,	
unit	<b>Steam jacketed kettle</b> , stainless steel food grade, ¼"thick, with detachable mechanical stirrer, insulated steam lines from header, with drain.	



**LOT-5: BACKHOE EXCAVATOR, DUMP TRUCK & PORTABLE CONCRETE MIXER  
 (ABC: PhP6,580,000.00, QTY: 4)**

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<b>Backhoe Excavator</b> with air conditioned cab and concrete breaker attachment, CDM 6150 – Original Cummins Engine 4BT, Komatsu counterpart PC150, Chain type, 0.56 cu m. bucket capacity.	
unit	<b>Dump Truck</b> with air conditioned cab, ETX Auman 12 wheeler, 25cu.m. WP12.380E32, 11596cc, 380HP	
unit	<b>Portable Concrete Mixer</b> , 1 bagger mixer, with diesel or gasoline engine, 18HP, with wheels	



## LOT-6: SMART GRID (ABC: PhP10,000,000.00, QTY: 1)

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<p><b>SMART GRID:</b>            THREE-PHASE SUPPLY UNIT. This power supply unit must be suitable three-phase connection with 4-pole main switch. 25 A current operated earth leakage circuit breaker, sensitivity 30 mA. Three-phase indicator lamps. Output through 5 safety terminals: L1, L2, L3, N and PE. Switch for simulation of wind or photovoltaic energy power source. Modbus RS485 Protocol Communication. This module must have insulated type front panel with the electrical scheme; it must include also safety terminals. THREE-PHASE TRANSFORMER-didactic equipment 3 pcs. Three-phase transformer for feeding a transmission line model 380 kV with scale factor 1:1000.</p> <p><i>Primary</i></p> <ul style="list-style-type: none"> <li>• 3 x 380 V windings with tap at 220 V</li> <li>• Star or delta connection</li> </ul> <p><i>Secondary</i></p> <ul style="list-style-type: none"> <li>• 3 x 220 V windings with taps at +5%,-5%,-10%,-15%</li> <li>• Star connection for 3 x 380 V</li> <li>• Various star connections possible</li> <li>• Rated power: 800 VA</li> </ul> <p><b>FEEDER MANAGER RELAY</b>-didactic equipment. Three-phase Current, Voltage and Earth Fault multifunction relay for protection and management of MV/HV distribution lines. Real time measurements of the primary value of the input quantities are continuously available from relay's display and from the serial communication port. Relay's programming and setting must be made directly by the front face keyboard or via the serial communication ports. Setting, event recording and oscillography must be stored into non-volatile memory (E2prom). The relay must be fitted with a multi-voltage, auto ranging power supply unit self-protected and transformer isolated.</p> <ul style="list-style-type: none"> <li>• Three levels for phase overcurrent independently programmable as directional or non-directional.</li> <li>• Three levels for Earth Fault independently programmable as directional or non-directional.</li> <li>• Selectable Time current curves according to IEC and IEEE standards.</li> <li>• Two over/under voltage levels.</li> <li>• Two over/under frequency levels.</li> <li>• Zero sequence overvoltage level.</li> <li>• Two Negative Sequence current levels.</li> <li>• One Positive Sequence overvoltage level.</li> <li>• One Negative Sequence under-voltage level.</li> <li>• Two Reactive Power (VAR) control levels (optional).</li> <li>• Trip circuit supervision.</li> <li>• Associated Circuit Breaker control (OPEN / CLOSE)</li> <li>• Breaker failure protection.</li> <li>• RS232 serial communication port on Front Face</li> <li>• RS485.</li> <li>• Output relays totally user programmable.</li> <li>• Digital inputs user programmable.</li> </ul> <p><b>LINE MODEL</b>-didactic equipment. Three-phase model of an overhead power transmission line 360 km long, voltage 380 kV and current 1000 A • Scale factor: 1:1000            Line resistance: 13 Ω, line inductance: 290 mH, mutual capacitance: 1 μF, earth capacitance: 2 μF earth resistance: 11 Ω, earth inductance: 250 mH.</p> <p><b>LINE MODEL</b>-didactic equipment. Three-phase model of an overhead power transmission line 100 km long, voltage 380 kV and current 1000 A • Scale factor: 1:1000.</p> <p><b>MAXIMUM DEMAND METER</b>-didactic equipment 3 pcs. The module must consist of a microprocessor controlled three-phase power analyzer. It must have insulated front panel and it must be suitable for the measurement of voltages,</p>	



currents, frequencies, active power, reactive power, apparent power. Input voltage: 450 V (max 800 Vrms). Input current: 5 A (max 20 Arms). Operating frequency: 47 ÷ 63 Hz. Auxiliary supply: single-phase from mains on the front panel, it must include a RS485 port, on/off switch and LCD display with the following features: energy count: 8 digit counter reading updates: 1, 1 seconds. The module must be supplied with manual in English language.

**POWER CIRCUIT BREAKER**-didactic equipment 3 pcs. Three-phase power circuit breaker with normally closed auxiliary contact.

- Contact load capability: 400 Vac, 3 A
- Supply voltage: single-phase from mains.

The item must include two light push buttons (one red and one green) and must have insulated front panel. The unit must be supplied with a manual in English language.

**GENERATOR SYNCHRONISING RELAY**-didactic equipment. It must consist in a numerical synchronizing relay which measures voltage and frequency of two inputs; The voltage, frequency and phase angle of the Generator input (G) must be individually compared with those of the Bus input (B) considered as reference.

Functions:

- Automatic Synchronization and Synchro-check.
- Fast proportional Voltage and Frequency regulation.
- Phase displacement checking with circuit breaker closing time control.
- Anti-motoring
- Kicker pulse
- Event Recording.
- Modbus Communication Protocol. Synchronizing of the generator with the reference bus
- Normal/Dead Bus operation modes Adjustable Operate time delay.
- Adjustable Max Voltage difference Anti-motoring control
- Automatic Adjusting of phase angle for circuit breaker close.
- Adjustable Max Frequency difference.
- Adjustable Max Phase displacement.
- Adjustable Increase/Decrease pulses to speed regulator.
- Adjustable Increase/Decrease pulses to voltage regulator.
- Adjustable Min/Max Bus voltage for synchronizing operation.
- Adjustable Min/Max Bus frequency for synchronizing operation
- Kicker pulse control on steady phase displacement
- Fast synchronization with control pulses proportional to speed and voltage difference 3 Digital Inputs optically isolated 2kV.

**MOTOR-DRIVEN POWER SUPPLY UNIT**-didactic equipment. Housed in metallic box with PVC label. Suitable for power supplying with variable voltage the braking systems and the excitation of the machines through manual or automatic operation. According to the IEC standards, must be arranged on the front panel, clearly interconnected through a schematic diagram.

Technical features:

Automatic power supply unit with the following features:

- Continuously adjustable output voltage: 0 to 210V • fixed output current: max 2A • magneto-thermal protection • analog signal INPUT terminal and connectors: 0 to 10V The module must be equipped with: Pilot lamp Potentiometer for variable regulation. Control system selection switch (auto - manual). Magneto-thermal protection of variator, Terminals for system connection, Ground terminal, Output terminals, Power supply: 220 V, 50/60 Hz. The unit must be supplied with a manual in English language

**ELECTRICAL POWER DIGITAL MEASURING UNIT**-didactic equipment 2 pcs. It must be suitable for the measurement in direct current of: voltage, current, power and energy. Measurement in alternate current of: voltage, current, power, active energy, reactive energy, apparent energy, cosphi and frequency. Main technical features: DC voltage: 300 Vdc - DC current: 20 Adc - AC voltage: 450 Vac AC current: 20 Aac - Power: 9000 W Power supply: single-phase, 90-260 V, 50/60 Hz Communication: RS485 with MODBUS RTU protocol. The unit must be supplied with a manual in English language. **BRUSHLESS MOTOR WITH CONTROLLER**-didactic equipment 2 pcs. Module for the study of automatic control for a brushless motor. • Control and operation of a brushless motor in voltage. The system must allow the study of the operation of a brushless motor of typical



industrial process automation. The student must have the opportunity to learn to control and parameterize an automatic operation. The control and monitoring system must be done through software that will be able to:

- Set system parameters
- Draw graphic curves
- Monitor real-time system (torque, speed)

Specifications: 1kW power brushless motor with electronic encoder. Mechanical braking system for the analysis of the couple. Encoder outputs for the analysis of speed. Display system for controlling and monitoring events. Button start and stop action and automatic stop intervention in case of alarm. Complete software for PC interfaced to the system via RS485. **THREE-PHASE SYNCHRONOUS MACHINE**-didactic equipment machine with smooth inductor and three-phase stator armature winding for operation either as an alternator or as a synchronous motor. Technical features: Power: 1 kVA-Voltage: 220/380 V D/Y - Current: 2.6/1.5 A D/Y-Speed: 1500 rpm-Excitation winding on the rotor. It must be possible to couple the electrical machine with other electrical machines through a hub and spider elastic gear ring in polyurethane. It must be supplied with a hooked module in aluminum with PVC label and safety terminals for the electrical connection. A schematic diagram must be shown on the hooked module. Each machine must be mounted on a base and must be provided with:

- Plate that brings its axis height to the standard measure (112 mm).
  - Plates for fixing to the base of the machine
  - Four screws for fixing of the machine Inter Rail Distance of the plates: 160mm
- Coupling Joint: Diameter: 40mm, length 40mm. The motor must be supplied with manual in English language.

**RESISTIVE LOAD**-didactic equipment. It must consist of a single or three-phase resistive step-variable load.

**MECHANICAL FEATURES:** metallic box: on the front panel all the controls, the protections, the output terminals and a schematic diagram on PVC label must be shown.

**ELECTRICAL FEATURES**

The load must be composed by three resistances, with possibility of star, delta and parallel connection, controlled by a three switches. As a function of the switch positions, there must be the following phase values: Position Resistance

Max power per phase

- 1 1050 Ohm 46 W
- 2 750 Ohm 65 W
- 3 435 Ohm 110 W
- 4 300 Ohm 160 W
- 5 213 Ohm 230 W
- 6 150 Ohm 330 W
- 7 123 Ohm 400 W

Maximum power in single or three phase connection is 1200 W. Rated voltage in star connection 380 V, in D connection is 220V, in single-phase 220V. The unit must be supplied with a manual in English language.

**INDUCTIVE LOAD**-didactic equipment. It must consist of a single or three-phase inductive step-variable load. Housed in a metallic box.

**MECHANICAL FEATURES:** metallic box: on the front panel all the controls, the protections, the output terminals and a schematic diagram on PVC label must be shown.

**ELECTRICAL FEATURES**

The load must be composed by three inductances, with possibility of star, delta and parallel connection, controlled by a three switches. As a function of the switch positions, there must be the following phase values: Position Inductance

Max. Power per phase

- 1 4.46 H 34 VAR
- 2 3.19 H 48 VAR
- 3 1.84 H 83 VAR
- 4 1.27 H 121 VAR
- 5 0.90 H 171 VAR
- 6 0.64 H 242 Var
- 7 0.52 H 297 VAR

Max reactive power 890 VAR in three-phase or single-phase connection. Rated voltage in star connection 380V, in D connection is 220V, in single-phase 220V. The unit must be supplied with a manual in English language.





**CAPACITIVE LOAD**-didactic equipment. It must consist of a single or three-phase capacitive step-variable load. Housed in a metallic box.

**MECHANICAL FEATURES**

The load shall be composed of a rugged metal structure and on the front panel all the controls, the protections, the output terminals and a clear synoptic diagram shall be collected. This item must be provided also with fuses protection.

**ELECTRICAL FEATURES**

The load shall be composed of capacitors, with possibility of star, delta and parallel connection, controlled by three switches. As a function of the switch position, there shall be the following phase values (at 50Hz):

Position Capacitance Max power per phase

1 2 uF 30 VAR

2 3 uF 45 VAR

3 5 uF 76 VAR

4 8 uF 121 VAR

5 10 uF 152 VAR

6 13 uF 197 VAR

7 18 uF 275 VAR

Max reactive power in single-phase or three-phase connection 825 VAR. Rated voltage in star connection must be 380V, in D connection must be 220V, in single-phase must be 220V. 4 mm. safety terminal included on the front panel for the electrical connection.

**SLIP RING THREE-PHASE ASYNCHRONOUS MOTOR**-didactic equipment. Induction motor with both three-phase stator winding and squirrel cage buried in the rotor. Technical features: Power: 1.5 kW - Voltage: 220/380 V D/Y-4 poles - Speed: 1500 rpm, 50 Hz; 1800 rpm, 60 Hz. It must be possible to couple the electrical machine with other electrical machines through a hub and spider elastic gear ring in polyurethane. It must be supplied with a hooked module in aluminum with PVC label and safety terminals for the electrical connection. A schematic diagram must be shown on the hooked module. Each machine must be mounted on a base and must be provided with:

- Plate that brings its axis height to the standard measure (112 mm).
- Plates for fixing to the base of the machine
- Four screws for fixing of the machine

Inter Rail Distance of the plates: 160mm, Coupling Joint: Diameter: 40mm, length 40mm. The motor must be supplied with manual in English language.

**COMMUNICATION MODBUS**-didactic equipment module with insulated front panel including: two RS485 inputs and six RS485 outputs. Analog output 1 0 to 10V. Analog output 2 0 to 10V. One switch for power on/off and a port for power supply connector. The unit must be supplied with a manual in English language **SOFTWARE** for control and data acquisition that must permit the operations of control and data acquisition.

**CIRCUIT BREAKER**-didactic equipment • Current Max.: 10A

• Intervention threshold differential: 30mA. It shall correspond to a protective module that contains one input, one output and a 2-pole residual current device. It shall have insulated front panel that will include residual current device, AC input terminals and AC output terminals.

**INVERTER GRID**-didactic equipment Grid tie power inverter that must ensure that the power supplied will be in phase with the grid power. The module shall have 12 V solar panel input, ground terminal and AC terminals; in this module power inverter must be programmed to supply load from PV source and surplus energy will be sent to the mains grid. The module must have insulated front panel and include the following elements:

- 1) island protection indicator
- 2) output power indicators
- 3) PV panel input terminals
- 4) PE terminal
- 5) mains terminals

• Current Max.: 30A

• Voltage: 12V

• Power: 360W

**PHOTOVOLTAIC INCLINABLE MODULE**-didactic equipment 85W, 12V, complete



cell for measuring of solar radiation and with a sensor temperature PANEL WITH LAMPS FOR PHOTOVOLTAIC TRAINER

It must be possible to adjust manually or automatically the light intensity controlled by a potentiometer through a 0-10 V input, to allow to perform experiments with different light intensities, then simulating the light conditions from dawn to dusk.

- 4 halogen lamps 300 W each
- Dimmer to control the intensity of light
- 10 A Differential Circuit Breaker
- 10 k Potentiometer

**WIND SIMULATOR**

System composed of: wind speed and direction sensor, power supply, fan, potentiometer, measurement circuit, RJ45 and RS485 port. It must allow simulating the wind force and direction.

SWITCHABLE CAPACITOR BATTERY-didactic equipment Switching system with which different capacitance values that must be possible to connect to the mains for reactive power compensation. Four switching levels each consisting of 3 capacitors in star connection with discharging resistors:

- level 1 (b1 coil): 3 x 2  $\mu$ F/450 V
- level 2 (b2 coil): 3 x 4  $\mu$ F/450 V
- level 3 (b3 coil): 3 x 8  $\mu$ F/450 V
- level 4 (b4 coil): 3 x 16  $\mu$ F/450 V

Compensation power: max 1360 VAR at 50 Hz, 380 V. It must be possible to control separately each switching level:

- Internally, through 4 toggle switches
- Externally, through 4 control inputs Coil operating voltage: 220 Vac.

REACTIVE POWER CONTROLLER-didactic equipment. Relay for automatic adjustment of the power factor in systems with inductive load. Power factor adjustment range: 0.9 ... 0.98 ind Sensitivity: 0.2 ... 1.2 K 2 decimal digit display, Output relay for batteries connection: 4 NO contacts with LED indication, Output relay contact: 400 Vac, 5 A, Supply voltage: three-phase from mains Ammetric input circuit: 5 A (250 mA min.) Automatic detection of the frequency. SCOPE ACQUISITION-didactic equipment 6 analog inputs 914-bit,48kS/s 2 analog outputs (12-bit); 12 digital I/O; 32 – bit counter USB Bus-powered; built – in signal connectivity. Frequency range: dc to 80 kHz, Input voltage: Max 620 Vdc/460Vac, Input resistance  $R_i = 1$  MW, Three-stage attenuator: 1:1; 1;10; 1:100, Accuracy;: +/- 2% of full scale range, Input current: Max:10A continuous, 16 A fort<15min; 20A for t<2 min, Internal resistance: 30mW, Two-stage attenuator: 1VA; 1/3 V/A, Accuracy: +/- 5% of full scale range, Computer all-in-one for smart grid system Signal Bar, Mains sockets, Socket Extension, Insolation transformer. UNIVERSAL BASE 2 pcs-Didactic equipment: this item must consist of a steel alloy varnished structure mounted on anti-vibration rubber feet, provided with slide guides for the fixing of one or two machines and with a coupling guard. Complete with a device for the locking of the rotor of the slip ring asynchronous machines in the short-circuit test. Composition: -Light alloy base, leveled on the upper supporting planes, with two guides for all the couplings of machines rated 1 kW. In the lower section high sensitivity shock absorbers must be mounted, arranged to be fixed to a supporting plane. Removable butt strap in varnished plate. Flask for the blocked rotor test in varnished light alloy

CONNECTING LEADS kit of cables with security plugs of different colours, length and sections. DOUBLE 3 LEVELS FRAME WORK TABLE 2 pcs.



**LOT-7: ELECTRIC MACHINES (ABC: PhP1,500,000.00, QTY: 1)**

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<p><b><u>ELECTRIC MACHINES</u></b> – OPENLAB - 0.2 Kw Dissectible Electrical Machine Manual Configurations. Fully dissectible experimental rotating machines system ,Ac/dc power supply, Loads and Rheostat Module ,Electrical Power Measurement Module, Electrical and Speed Measurement, Multi-meter with virtual instrumentation, Parallel Board, Star/Delta Starter, Starting and Synchronization, Fault Simulators, Pole Changing Unit, Electromagnetic Brake, Adapter Bracket, Locking and Rotating Device, Motor Driven AC/DC Power Supply. Mechanical Power Measurement Module, Load Cell 100 N Motor Driven Resistive Load Unit Motor Driven Power Supply for Brake Computerized Data Acquisition System Via USB Data Acquisition and Processing Software for Electric Machines.</p>	



## LOT-8: LINEAR CIRCUIT LAB (1), LINEAR CIRCUIT LAB (2), AND ELECTRICAL & ELECTRONIC CIRCUIT LAB (ABC: PhP2,750,000.00, QTY: 3)

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<p><b>LINEAR CIRCUIT LAB (1)</b> - Electric Circuits Lab Includes:            TINA Design Suite Educational Edition</p> <ol style="list-style-type: none"> <li>1. DC Power Supply               <ol style="list-style-type: none"> <li>(1) Fixed DC power supply                   <ol style="list-style-type: none"> <li>a. Voltage range : <math>\pm 5V, \pm 12V</math></li> <li>b. With output overload protection</li> </ol> </li> <li>(2) Dual DC power supply                   <ol style="list-style-type: none"> <li>a. Voltage range : <math>\pm 3V \sim \pm 18V</math>, continuously adjustable</li> <li>b. With output overload protection</li> </ol> </li> </ol> </li> <li>2. AC Power Supply               <ol style="list-style-type: none"> <li>(1) Voltage range : <math>9V \sim 0V \sim 9V</math></li> <li>(2) With output overload protection</li> </ol> </li> <li>3. Function Generator               <ol style="list-style-type: none"> <li>(1) Output waveform : Sine, square and triangle</li> <li>(2) Output frequency : <math>10 \text{ Hz} \sim 100 \text{ KHz}</math>, 4 settings, continuously adjustable</li> <li>(3) Accuracy : <math>\pm 5\%</math> of full scale value</li> <li>(4) Output impedance : <math>50\Omega</math></li> <li>(5) Output voltage : <math>\geq 18V_{p-p}</math> (open loop) <math>\geq 9V_{p-p}</math> (with <math>50\Omega</math> load)</li> </ol> </li> <li>4. 3 1/2-Digit Digital Voltmeter / Ammeter               <ol style="list-style-type: none"> <li>(1) DC voltage range : 2V, 200V</li> <li>(2) DC voltage accuracy : <math>\pm 0.3\%</math> of reading + 1 digit</li> <li>(3) DC current range : <math>200\mu A, 2000mA</math></li> <li>(4) DC current accuracy : <math>\pm 0.5\%</math> of reading + 1 digit</li> </ol> </li> <li>5. Analog Meters               <ol style="list-style-type: none"> <li>(1) AC current : <math>0 \sim 100mA \sim 1A</math></li> <li>(2) AC voltage : <math>0 \sim 15V</math></li> <li>(3) DC current : <math>0 \sim 100mA \sim 1A</math></li> <li>(4) DC voltage : <math>0 \sim 20V</math></li> </ol> </li> <li>6. Speaker one <math>8\Omega, 0.25W</math> speaker with driver circuit</li> <li>7. Variable Resistors               <ol style="list-style-type: none"> <li>(1) <math>1K\Omega, 0.25W</math> variable resistor with 3 terminals (A,B,C)</li> <li>(2) <math>10K\Omega, 0.25W</math> variable resistor with 3 terminals (A,B,C)</li> <li>(3) <math>100K\Omega, 0.25W</math> variable resistor with 3 terminals (A,B,C)</li> <li>(4) <math>1M\Omega, 0.25W</math> variable resistor with 3 terminals (A,B,C)</li> </ol> </li> <li>8. Breadboard (AC-90001) 1680 tie-point breadboard on top panel can be easily put into and taken off.</li> </ol>	



unit	<p><b>LINEAR CIRCUIT LAB (2)</b> - Electronic Circuits Lab Includes:          TINA Design Suite Educational Edition Main Unit (KL-21001)</p> <ol style="list-style-type: none"> <li>1. DC Power Supply             <ol style="list-style-type: none"> <li>(1) Fixed DC power supply                 <ol style="list-style-type: none"> <li>a. Voltage range : <math>\pm 5V, \pm 12V</math></li> <li>b. With output overload protection</li> </ol> </li> <li>(2) Dual DC power supply                 <ol style="list-style-type: none"> <li>a. Voltage range : <math>\pm 3V \sim \pm 18V</math>, continuously adjustable</li> <li>b. With output overload protection</li> </ol> </li> </ol> </li> <li>2. AC power supply             <ol style="list-style-type: none"> <li>(1) Voltage range : <math>9V \sim 0V \sim 9V</math></li> <li>(2) With output overload protection</li> </ol> </li> <li>3. Function Generator             <ol style="list-style-type: none"> <li>(1) Output waveform : Sine, square and triangle</li> <li>(2) Output frequency : <math>10 \text{ Hz} \sim 100 \text{ KHz}</math>, 4 settings, continuously adjustable</li> <li>(3) Accuracy : <math>\pm 5\%</math> of full scale value</li> <li>(4) Output impedance : <math>50\Omega</math></li> <li>(5) Output voltage: <math>\geq 18V_{p-p}</math> (open loop) <math>\geq 9V_{p-p}</math> (with <math>50\Omega</math> load)</li> </ol> </li> <li>4. 3 1/2-Digit Digital Voltmeter/Ammeter             <ol style="list-style-type: none"> <li>(1) DC voltage range : <math>2V, 200V</math></li> <li>(2) DC voltage accuracy : <math>\pm 0.3\%</math> of reading + 1 digit</li> <li>(3) DC current range : <math>200\mu A, 2000mA</math></li> <li>(4) DC current accuracy : <math>\pm 0.5\%</math> of reading + 1 digit</li> </ol> </li> <li>5. Analog Meters             <ol style="list-style-type: none"> <li>(1) AC current : <math>0 \sim 100mA \sim 1A</math></li> <li>(2) AC voltage : <math>0 \sim 15V</math></li> <li>(3) DC current : <math>0 \sim 100mA \sim 1A</math></li> <li>(4) DC voltage : <math>0 \sim 20V</math></li> </ol> </li> <li>6. Speaker one <math>8\Omega</math>, 0.25W speaker with driver circuit</li> <li>7. Variable Resistors             <ol style="list-style-type: none"> <li>(1) <math>1K\Omega</math>, 0.25W variable resistor with 3 terminals (A,B,C)</li> <li>(2) <math>10K\Omega</math>, 0.25W variable resistor with 3 terminals (A,B,C)</li> <li>(3) <math>100K\Omega</math>, 0.25W variable resistor with 3 terminals (A,B,C)</li> <li>(4) <math>1M\Omega</math>, 0.25W variable resistor with 3 terminals (A,B,C)</li> </ol> </li> </ol>
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unit	<p><b><u>ELECTRICAL AND ELECTRONIC CIRCUIT LAB-</u></b> Includes: TINA Design Suite Educational Edition Main Unit (KL-22001)</p> <ol style="list-style-type: none"> <li>1. DC Power Supply       <ol style="list-style-type: none"> <li>(1) Fixed DC power supply           <ol style="list-style-type: none"> <li>a. Voltage : 5V, 12V</li> <li>b. With output overload protection</li> </ol> </li> <li>(2) Dual DC power supply           <ol style="list-style-type: none"> <li>a. Voltage range : 3V~ 18V continuously adjustable</li> <li>b. With output overload protection</li> </ol> </li> </ol> </li> <li>2. AC Power Supply       <ol style="list-style-type: none"> <li>(1) Voltage range : 9V~0V~9V</li> <li>(2) With output overload protection</li> </ol> </li> <li>3. Signal Generator       <ol style="list-style-type: none"> <li>(1) Pulse generator : (TTL level)           <ol style="list-style-type: none"> <li>a. Frequency range : 1Hz~10KHz/4 settings, continuously adjustable</li> <li>b. Fan out : 10 TTL load</li> </ol> </li> <li>(2) Pulse switches           <ol style="list-style-type: none"> <li>a. 2 independent output, TTL level</li> <li>b. With Q, Q output, pulse width &gt; 5ms</li> <li>c. Fan out : 10 TTL load</li> </ol> </li> <li>(3) Data switches           <ol style="list-style-type: none"> <li>a. 8 set independent control output TTL level with DEBOUNCE circuit.</li> <li>b. Fan out : 10 TTL load</li> </ol> </li> </ol> </li> <li>4. Function Generator       <ol style="list-style-type: none"> <li>(1) Output waveform : Sine triangle, square</li> <li>(2) Output frequency : 10~100KHz/4 settings, continuously adjustable</li> <li>(3) Output amplitude : <math>\geq 18V_{pp}</math> (open circuit) <math>\geq 9V_{pp}</math> (50 <math>\Omega</math> load)</li> </ol> </li> <li>5. Testing And Display       <ol style="list-style-type: none"> <li>(1) 3 1/2 digital voltmeter /ammeter           <ol style="list-style-type: none"> <li>a. DC voltage range : 2V 200V</li> <li>b. DC voltage accuracy : (0.3% of reading+1digit)</li> <li>c. DC current range : 200<math>\mu</math>A 2000mA</li> <li>d. DC current accuracy : (0.5% of reading +1digit)</li> </ol> </li> <li>(2) Galvanometer           <ol style="list-style-type: none"> <li>a. Current range : 50mA</li> <li>b. Accuracy Class 2.5</li> </ol> </li> <li>(3) LED indicator           <ol style="list-style-type: none"> <li>a. 10 sets independent LED indicates high, low logic state</li> <li>b. Input impedance : <math>\geq 100K \Omega</math></li> </ol> </li> <li>(4) Digital display           <ol style="list-style-type: none"> <li>a. 2 sets independent 7-segment LED</li> <li>b. With BCD-7segment decoder/driver and DP Input</li> <li>c. Input with 8-4-2-1 code</li> </ol> </li> </ol> </li> <li>6. Breadboard (AC-90001) 1680 tie-point breadboard on top panel can be easily put into and taken off</li> </ol>
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## LOT-9: DIGITAL LOGIC LAB (ABC: PhP800,000.00, QTY: 1)

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<p><b><u>DIGITAL LOGIC LAB</u></b>            Includes: TINA Design Suite Educational Edition. Main Unit (KL 31001)</p> <ol style="list-style-type: none"> <li>1. Dual DC Power Supply               <ol style="list-style-type: none"> <li>(1) Voltage range : +5V, 1.5A; -5V, 0.3A; ±12V, 0.3A</li> <li>(2) With output overload protection</li> </ol> </li> <li>2. Adjustable DC Power Supply               <ol style="list-style-type: none"> <li>(1) Voltage range : +1.5V~+15V</li> <li>(2) Maximum current output : 0.5A</li> <li>(3) With output overload protection</li> </ol> </li> <li>3. Standard Frequency               <ol style="list-style-type: none"> <li>(1) Frequency : 1MHz, 60Hz, 1Hz</li> <li>(2) Accuracy : ±0.01% (1MHz)</li> <li>(3) Fan out : 10 TTL load</li> </ol> </li> <li>4. Clock Signal Generator               <ol style="list-style-type: none"> <li>(1) Frequency : 1Hz-1MHz (6 ranges)                   <ol style="list-style-type: none"> <li>a. 1Hz ~ 10Hz d. 1KHz ~ 10KHz</li> <li>b. 10Hz ~ 100Hz e. 10KHz ~ 100KHz</li> <li>c. 100Hz ~ 1KHz f. 100KHz ~ 1MHz</li> </ol> </li> <li>(2) Fan out : 10 TTL load</li> </ol> </li> <li>5. Data Switch               <ol style="list-style-type: none"> <li>(1) 8-bit DIP switch x 2, 16-bit TTL level output</li> <li>(2) Toggle switch x 4, each with DEBOUNCE circuit</li> <li>(3) Fan out : 10 TTL load</li> </ol> </li> <li>6. Pulser Switch               <ol style="list-style-type: none"> <li>(1) 2 sets of independent control output</li> <li>(2) Each set with Q, Q output, pulse width &gt; 5ms</li> <li>(3) Each set of switch with DEBOUNCE circuit</li> <li>(4) Fanout: 10 TTL load</li> </ol> </li> <li>7. Line Signal Generator               <ol style="list-style-type: none"> <li>(1) Frequency : 50 / 60Hz</li> <li>(2) Output voltage : 6Vrms</li> <li>(3) With overload protection</li> </ol> </li> <li>8. Thumbwheel Switch 2-digit, BCD code output and common point input</li> <li>9. Logic Indicator               <ol style="list-style-type: none"> <li>(1) 16 sets of independent LED indicates high and low logic state</li> </ol> </li> <li>10. Digital Displays               <ol style="list-style-type: none"> <li>(1) 4 sets of independent 7-segment LED display</li> <li>(2) With BCD, 7-segment decoder / driver and DP input</li> <li>(3) Input with 8-4-2-1 code</li> </ol> </li> <li>11. Logic Probe               <ol style="list-style-type: none"> <li>(1) TTL and CMOS level</li> <li>(2) 5mm LED displays</li> <li>(3) "Lo" and "Hi" LED display low and high logic state respectively</li> </ol> </li> <li>12. Speaker               <ol style="list-style-type: none"> <li>(1) One 8Ω, 0.25W speaker with driver circuit</li> </ol> </li> <li>13. Breadboard Modules (AC-90001)               <ol style="list-style-type: none"> <li>(1) 1680 tie-point breadboard on top panel can be easily put into and taken off.</li> </ol> </li> </ol>	



## LOT-10: ARDUINO TRAINER (ABC: PhP1,000,000.00, QTY: 1)

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<p><b>ARDUINO TRAINER</b></p> <ol style="list-style-type: none"> <li>Power Input: AC 110/220V, 50/60Hz, Output: +5V/1.5A, +3.3V/0.5A</li> <li>Control Board, Arduino UNO R3, Core: ATMEGA328P, Digital IO: 14 (D0-D13), Analog IO: 6(A0-A5), PWM Output: 6 (D3, D5, D6, D9, D1, D11), Support AREF pin, Support Tx/Rx pin, Support I2C interface, Support ISP download Programming interface: USB Type-B.</li> <li>Input Module Digital Input 4x4 Key Pad: Touch Button DIP Switch: 8 pin Analog Input Slide Potentiometer: 20KΩ x 2 Joystick x 1 Microphone x 1 Sensor Input CDS Sensor x 1 Temperature &amp; Humidity Sensor x 1 Accelerometer: 3-axis Ultrasonic x 1 Infrared transmitter &amp; receiver x 3.</li> <li>Output Module LED Matrix Display: 8x8 4-Digit 7-Segment Display LED Bar: 10 bit RGB LED x 20 LCD Display: 16x2 (Serial &amp; Parallel) Raly: 5V, 2 sets DC Motor: 5V, 2 sets Step Motor: 12V, 7.5 deg/tick Servo Motor: 4.8V-6V Electromagnetic Buzzer x 2</li> <li>Communication Module Wi-Fi: ESP8266 x 1 Bluetooth: HC05 x 1</li> <li>Other Module Solder less Breadboard: 81x62mm, 456 tie points List of Experiments           <ul style="list-style-type: none"> <li>Buzzer application: Mono tone output/ Multi tone output / Song playing</li> <li>LED matrix display: Static &amp; dynamic</li> <li>4-digit 7-segment display: Basic output/ Digital clock</li> <li>Relay control</li> <li>High power LED application: PWM control with slide potentiometer and PC</li> <li>Microphone application: Light detector</li> <li>Classical RGB LED control: Static/Dynamic display</li> <li>Serial RGB LED control: Color control</li> <li>Parallel LCD display control: Static display</li> <li>Serial LCD display control: Display temperature</li> <li>Ultrasonic application: Distance measurement</li> <li>Accelerometer application: Balance detection</li> <li>DC motor application : Speed and direction control</li> <li>Step motor application : Unipolar and Bipolar control</li> <li>Bluetooth application : Connect to mobile phone</li> <li>Wi-Fi application : Connect to cloud</li> <li>Infrared application: Line tracer</li> <li>Servo motor application: Control w/ slide potentiometer and joystick</li> </ul> </li> <li>Accessory Experiment manual x1 Software / Source Code CD x 1 AC Power Cord x 1 USB cable (Type-A to Type-B ) x 1 Flat cable (5x2 pin) x 1 DuPont wire x 40.</li> </ol>	





## LOT-11: RASPBERRY PI TRAINER (ABC: PhP1,000,000.00, QTY: 1)

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<u>Raspberry Pi Trainer</u>	



## LOT-12: HYDRAULIC PRESS (ABC: PhP1,500,000.00, QTY: 1)

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<p><b><u>Hydraulic Press, Hot and Flat Press</u></b>            Total pressure: 1200kN            Working layers: 3            Unit pressure: 3.7kgf/cm<sup>2</sup>            Platen No.&amp; Size: 4-2500x1300x42mm            Opening: 120mm            Cylinder No. &amp; Diameter: 8-φ 85mm            Heating way: electric heated            Installed power: 52.75kw            Closed speed: 40mm/s</p>	



**LOT-13: SIEVE SHAKER MACHINE & I. S. SIEVE SET (ABC: PhP350,000.00, QTY: 3)**

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<u>Sieve Shaker machine</u> , Motorized with Built-in Digital Timer	
unit	<u>I.S. sieve set;</u> I.S. Sieves 100 mm, 63 mm, 10 mm, 4.75 mm, 2mm, 1mm, 600u, 425u, 300u, 212u, 150u 75u sieves	



## LOT-14: ELECTRONIC THEODOLITE (ABC: PhP225,000.00, QTY: 3)

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<p><b>Electronic Theodolite:</b> Angle Measurement: Accuracy - 5", minimum Reading 1"/5"/10". Compensating range: +/- 3'; level parameter: Circular level - 8'/2mm. Plate level: 30"/2mm* Telescope: 30x magnification; field of view - 2.6% min, focus - 1.3m; optical aperture-45mm; length of sleeve-155mm; resolving power-2.5"; stadia ratio - 100</p>	



## LOT-15: HANDHELD GPS (ABC: PhP270,000.00, QTY: 6)

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<b>Handheld GPS</b> , Worldwide base map 2.2" 65K color, sunlight readable display 3-axis compass and barometric altimeter wireless capability to share waypoints, routes and geocaches with other similar devices GPS and GLONASS satellites for faster positioning	



**LOT-16: HYDROSTATIC BENCH WITH SLOTTED WEIGHT AND TANK  
(ABC: PhP3,955,000.00, QTY: 1)**

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<b>Hydrostatic Bench with slotted weight and tank,</b> Tank: Storage capacity: 50 liters Densities: Volume pyncmeter: 50 ml	



**LOT-17: PERSONAL COMPUTER WITH ACCESSORIES & A3 PRINTER WITH PRINT MATERIALS (ABC: PhP483,000.00, QTY: 13)**

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<u>Personal Computer with Accessories</u> , Intel Core i7, 4GB RAM, 1TB	
unit	<u>A3 Printer with print materials</u> , Model: MFC-J3720	



**LOT-18: STRUCTURAL ENGINEERING LEARNING CENTER WITH MULTIMEDIA  
(ABC: PhP1,800,000.00, QTY: 1)**

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<u>Structural Engineering Learning Center with multimedia</u>	





## LOT-19: LED TV & DIGITAL CAMERA (ABC: PhP1,078,000.00, QTY: 21)

ITEM	SPECIFICATION	STATEMENT OF COMPLIANCE
unit	<b>Classroom LED TV</b> , 50 inch with swinging mount, Ultra high definition, USB & HDMI ready, with 3 meters HDMI cable.	
unit	<b>Camera</b> , Digital single lens reflex with standard & lens built-in flash, 12 mega pixels minimum, with camera bag sling and tripod.	