TENDER DOCUMENTS

ELECTRICAL LAB EQUIPMENT

NUTECH/SCM/Elec Lab-2019/TD-062

NATIONAL UNIVERSITY OF TECHNOLOGY

TENDER NOTICE

National University of Technology (NUTECH)

NUTECH/SCM/Elec Lab-2019/TD-062

ELECTRICAL LAB EQUIPMENT NUTECH/SCM/Electrical Lab-2019/TD-032 stands cancelled.

Sealed bids are invited from Government / FBR Registered Firms for the procurement of Electrical laboratory equipment for NUTECH Technology Labs.

1. Tender documents containing terms & conditions and detailed specifications of items can be downloaded from NUTECH website "https://nutech.edu.pk/d-p.php" w.e.f **02 May 2019.**
2. Quotations shall be submitted as per requirement of the tender documents.
3. Bidders will be required to submit bank draft/PO equal to 5% of quoted value as Bid Bond in favor of National University of Technology (NUTECH).
4. Sealed bids with detailed specification should reach on the following address latest by **1030 hours on 20 May 2019.** Late submission will not be entertained.
5. Bids will be opened at **1100 hours** on **20 May 2019** at SCM Office.
6. Project is to be completed in 60 days from the date of award of contract.
7. Submit Rs 1500/-as Tender fee in favour of NUTECH HBL account: **NUTECH Tendering and contracts, 5037-7000210755**.Please attach bank receipt with technical offer. Offers will not be entertained without payment of processing fee.

Deputy Director (Supply Chain Management Office)
NATIONAL UNIVERSITY OF TECHNOLOGY (NUTECH) IJP ROAD, SEC I-12,
ISLAMABAD
Tel: 0092-51-5476768, Ext :178

NATIONAL UNIVERSITY OF TECHNOLOGY
SUPPLY CHAIN MANAGEMENT OFFICE

INVITATION TO TENDER

Submission Date/Time 20 May 2019 at 1030 hours

1.   NUTECH desires to procure the list of item(s)/Store(s) as per **Annexure-A**. Interested bidders are requested to send their bids through courier or deliver at NUTECH under <u>two separate sealed envelopes (placed together in third envelope)</u>, marked clearly, **"Technical Offer"** and **"Commercial Offer"**, respectively to the undersigned, latest by or before above mentioned due date. If due to any unforeseen circumstances, NUTECH establishment remains closed, then the last date of submission will be extended to next working day.

2.   Please also note that Technical Offer should contain Annexes-A & B duly filled in (supported with relevant technical literature /details/ catalogues etc) and receipt of tender processing fee. Commercial Offer will contain Annexure- C and bid bond. Please ensure no space is left blank in the annexes.

3.   Following must be noted for this IT (Invitation to Tender):-

    a.   2 x copies of technical offer are to be provided.

    b.   Annexes A, B and C must be signed and stamped, Attach only relevant documents.

    c.   Please complete all document as per given format. Do not use any other format or letter head. Offer may be rejected if given format is not followed.

    d.   Validity of offer will be 90 days.

    e.   Delivery period will be 60 days after the date of award of contract.

    f.   Tender(s) must be accompanied with a Bid Bond in agreement of faithful compliance of the conditions of Contract/Purchase Order. This amount will be equivalent to 5% of the total quoted value. In case of non-acceptance of any offer, the Bid Bond will be returned to the bidder by fastest possible means. The Bid Bond amount submitted by the successful bidder will however, be refunded on effective termination of Contract/ Purchase Order. (The Bid Bond will be forfeited in case of default by the bidder from his commitments made through his offer). Submission of Bid Bond is mandatory, otherwise your offer will be rejected.

    g.   2 years warranty against 5% bank guarantee will be required from the successful bidders from the date of commissioning.

    h.   Rates should be quoted on Free Delivery basis at NUTECH Islamabad.

4. We reserve the rights to accept or reject any or all tenders as a whole or in part without assigning any reason whatsoever. The decision in this regard will be firm, final and binding on all bidders.

DD (Supply Chain Management)

TECHNICAL OFFER

<div align="right">

Annex A
</div>

User Reference No **Elec Lab Eqpt-003**   Date: **29-04-2019**

Technical Specification

Ser	Nomen/ Experiment	Description	A/U	Country of Origin	Qty Req	Bidder Compliance			Tech Scrutiny to be done by user	
						Yes	**No**	**Alternate Offer**	**Accepted**	**Rejected**
									Reason of Rejection	
1.	**FPGA based Embedded Design Device**	• 10 analog input channels, 6 analog outputs, 40 digital I/O lines • Wireless, LEDs, push button, accelerometer onboard • FPGA with dual-core processor • Fully programmable with LabVIEW or C; adaptable for different programming levels **Accessories include** • Driver and software evaluation DVDs • USB cable • Power supply with international adapters • 1 MXP protoboard accessory • Sensors and Actuators Kit • Barrel connector with leads • Capacitors, Diodes, Resistors, 7-segment display, op-amps, LEDs, Microphone with audio	No	European/ American	10					

		jack, Breadboard Accessory, Potentiometer 500 kΩ, Relays 16, Piezoelectric sensor, Photocell, Photo interrupter (light sensor with LED), Hall effect sensors (latch and switch), Buzzer, • Small DC motor (1 VDC to 3 VDC, no load speed: 6600 rpm) • Assorted switches (DIP, slide, and rotary) • Thermistor (NTC: 10 kΩ, 25 degrees) • Assorted transistors • Force sensing resistor • Wire kit • Keypad • Digital temperature sensor (I2C) • Character LCD (I2C, SPI, and UART) • Digital potentiometer (SPI) • Bluetooth interface (UART) • EEPROM (SPI) • LED matrix • Geared motor 19:1 (includes encoder for rotation and speed, 12 V) • Ultrasonic range finder (accurate readings of 0 in. to 255 in. or 6.45 m) • Compass • Servo motor: standard (215 degrees rotation) • Servo motor: continuous rotation • Accelerometer (3 axis, digital - SPI and I2C) • H-bridge driver (compatible with gear motor) • Gyroscope (3 axis, digital -								

		SPI and I2C) • Infrared proximity sensor (10 cm to 80 cm) • Ambient light sensor **Or Equivalent**								
2.	**Robotics Kit with embedded controller (Rover Vehicle, Balancing Arm, Self-Balancing Robot)**	• Fully programmable with embedded design device • Motor Board to connect all included sensors and actuators with ease • Battery Charger • Sensors and actuators: Standard Servo, 2 DC Motors, Ambient Light Sensor, Gyro Sensor, IR rangefinder • Camera for Image Processing • Ability to connect to robot sensors and actuators • Obstacle avoidance, mapping, and path planning • Inverse kinematics, JAUS, and simulation capabilities • Includes all the necessary mechanical and electrical parts as well as instructions to construct 3 robot models directly out of the box. • Rover Vehicle • Balancing Arm • Self-Balancing Robot **Or Equivalent**	No	European/ American	10					
3.	**Digital Electronics and DLD Lab Platform with**	**Based Platform** • Seven hardware instruments plus control I/O containing 16 AI, 4 AO, and 40 DIO	No	European/ American	10					

	FPGA	• 4-channel, 100 MS/s oscilloscope sample rate with 14-bit resolution and 50 MHz bandwidth • 16-channel, 100 MS/s logic analyzer/pattern generator • 16-channel, 1 MS/s analog input with 16-bit resolution • 40 DIO lines individually programmable as input, output, PWM, or digital protocols **Add-On Board for Base Platform** • FPGA, programmable with Multisim and LabVIEW • 2.8 in. capacitive touch display • 8 LEDs, 8 slide switches, 4 push buttons, 4-digit 7-segment display • USB, Ethernet, and Micro SD card ports • Audio, VGA, and HDMI ports **Or Equivalent**							
4.	**Controls Trainer**	**Based Platform** • Seven hardware instruments plus control I/O containing 16 AI, 4 AO, and 40 DIO • 4-channel, 100 MS/s oscilloscope sample rate with 14-bit resolution and 50 MHz bandwidth • 16-channel, 100 MS/s logic analyzer/pattern generator • 16-channel, 1 MS/s analog input with 16-bit resolution • 40 DIO lines individually programmable as input, output, PWM, or digital protocols	No	European/ American	10				

		Add on For Base Platform • Highly linear brushed DC motor • Removable inertia load for variable dynamics • High-resolution optical encoder and current sense • Optional pendulum attached • Highly Linear Motor Response to enable directly relational modeling and control design • Access and customize all levels of the interfacing and control software • Complete Package: Hardware and courseware enable courses to cover the essentials of introductory and advanced controls • Simulink Compatibility **Or Equivalent**							
5.	**Digital/Analog Communication Labs**	**Based Platform** • Seven hardware instruments plus control I/O containing 16 AI, 4 AO, and 40 DIO • 4-channel, 100 MS/s oscilloscope sample rate with 14-bit resolution and 50 MHz bandwidth • 16-channel, 100 MS/s logic analyzer/pattern generator • 16-channel, 1 MS/s analog input with 16-bit resolution • 40 DIO lines individually programmable as input, output, PWM, or digital protocols **Add on For Base Platform** Hardware Blocks:	No	European/ American	10					

		• 100kHz BPF • 150kHz LPF • Adder x 2 • Analog MUX • Comparator • I&D and I&H • Limiter • Master Signals • Multiplier x 4 • Parellel/Serial • Phase Shifter • Precision Rectifier • RC LPF • RRC LPF x 4 • Sample and Hold • Generator x 2 • Speech • TLPF • VCO • X-OR • Oscilloscope 4ch, 100MS/s, 14bit • Function generator: 2ch, 100MS/s, 15MHz, 14bit • Logic analyzer 16ch, 100MS/s • IV analyzer: ±10 V, ±30 mA, 15 MHz • Digital Multimeter • Variable power supply: ±15 V, 500 mA • Processor FPGA • AI/AO: 16 ch, 16 bits/4 ch, 16 bits • DIO: 40ch • SFP Support: windows Mac, Web • Programming Language Support: LabVIEW, Python, C++							

		Or Equivalent								
6.	**DSP Kits**	**Multifunction DAQ device** • Compact, portable, and USB-powered device for use anywhere, anytime • Oscilloscope, DMM, Function Generator, Variable Power Supply, Bode Analyzer, Dynamic Signal Analyzer, Arbitrary Waveform Generator, DIO, • Single device provide 8 plug-and-play computer-based lab instruments • Data acquisition engine with analog inputs/outputs and digital lines • Extendable capabilities by programming with LabVIEW, C or MATLaB softwares • Simulate and compare with Multisim SPICE software **DSP Kit** • Tool for hands-on learning of digital filters • 50 MHz microchip DSP with anti-aliasing filters and reconstruction filters on the output • 32-bit precision to create filters up to the 10th order The included lab manuals provide exercises to support the student learning experience **Or Equivalent**	No	European/ American	10				

7.	Wireless Communications Teaching Bundle with 2 x 2 MIMO	• Software defined transceivers (2X2 MIMO, 70 MHz to 6 GHz) **Transmitter** Frequency range: 70 MHz to 6 GHz Frequency step <1 kHz Maximum output power (Pout): 20 dBm Gain range (The output power resulting from the gain setting varies over the frequency band and among devices): 89.75 dB Gain step: 0.25 dB Frequency accuracy (based on temperature-compensated crystal oscillator): 2.5 ppm Maximum instantaneous real-time bandwidth: 56 MHz **Maximum I/Q rate** Streaming: 15 MS/s Burst (One channel: 61.44 MS/s) Burst (Two channel: 30.72 MS/s) Digital-to-analog converter (DAC): 12 bits **Receiver** Frequency range: 70 MHz to 6 GHz Frequency step <1 kHz Gain range: 76 dB Gain step: 1.0 dB Maximum input power: -15dBm	No	European/ American	6				

		Noise figure: 5dB to 7dB							
		Frequency accuracy: 2.5ppm							
		Maximum instantaneous real-time bandwidth: 56 MHz							
		Maximum I/Q rate							
		Streaming: 15MS/s							
		Burst(One channel: 61.44MS/s)							
		Burst(Two Channel: 30.72MS/s)							
		ADC: 12 bits							
		Power							
		Typical: 3W to 3.5W							
		Maximum 4.5W							
		Power requirement: accepts a 6V, 3A external DC power connector							
		• Covers FM radio, GPS, GSM, Bluetooth, and ISM bands							
		• Up to 56 MHz bandwidth with USB 3.0 connectivity							
		Accessories							
		• 2 x Power Supplies							
		• 2 x 144 MHz, 400 MHz, 1200 MHz , Tri Band Vertical Antenna							
		• 2 x 824-960 MHz, 1710-1990 MHz Dual-band Vertical Antenna							
		Or Equivalent							
8.	**Spectrum Analyzer and High Frequency Waveform**	Consists of RF Transceiver Module and Embedded Controller A). 100 MHz Bandwidth RF Transceiver Adapter Module · RF TX and RX with shared LO · 200 MHz to 4.4 GHz frequency	No	European/ American	1				

		range · 100 MHz instantaneous bandwidth · LO input and output for MIMO synchronization · 12 bidirectional general-purpose digital I/O channels B). Embedded Controller for RF Transceiver · DSP-focused Xilinx Kintex-7 K325T FPGA programmable with the LabVIEW, C or MATLAB FPGA Module · 2 GB onboard DDR3 DRAM · Dual-core processor running Linux Real-Time **Or Equivalent**								
9.	**Test and Measurement Hardware for Microwave and Antenna**	· 70 MHz to 6 GHz, 2-Channel Software Defined Radio Device · Tunable RF transceiver with full-duplex, MIMO operation. · It offers bus-powered connectivity with USB 3.0 or USB 2.0. · Can also be used for following communications applications: white space; broadcast FM; public safety; land-mobile, low-power unlicensed device (ISM) bands; sensor networks; amateur radio; or GPS **Or Equivalent**	No	European/ American	6					
10.	**PCB Antennas Lab Trainer**	· PCB antennas lab is a complete training program for the study of the basic principles of antennas, their species, features and signal	No	European/ American	6					

		transmission basics.							
		· The system is used in the educational process to familiarize the user with the parameters of antennas and practical training for antenna measurements.							
		· Laboratory course is designed to gain knowledge in the following areas:							
		o Theory fundamentals							
		o Antenna parameters							
		o Measurement of antenna parameters							
		· With the use of the software, the students have the opportunity to make measurements with subsequent visualization of the test results in the form of graphs.							
		List of Labs							
		Study of varieties of antennas							
		1. Sleeve monopole antenna							
		2. Trapezoidal monopole antenna							
		3. G, L, T monopole antennas							
		4. Dual-band monopole antenna							
		5. Printed folded dipole antenna							
		6. Log-periodic antenna							
		7. Sierpinski bow-tie antenna							
		8. Micro strip - fed Vivaldi antenna							
		Study of main parameters of antennas							
		9. Directional response							

		10. Gain							
		11. Voltage Standing-Wave Ratio (VSWR)							
		12. Reflection index							
		13. Antenna input resistance							
		14. Half-Power Beam Width (HPBW)							
		15. First-Null Beam Width (FNBW)							
		Antennas main characteristics' comparison							
		Measurement results' comparison with theory							
		Or Equivalent							
11.	**Microwave Experiment Kit**	· An complete experimental equipment to educate Microwave Component Design, Manufacturing, and Measuring techniques include Microstrip line theory and Microwave device design theory	No	European/ American	6				
		Study the mocristrip line design theory							
		Study the basic theory of microwave component							
		Microwave component design & simulation							
		Microwave component manufacturing							
		Microwave component measurement							
		Microwave component analysis of characteristics							

		Or Equivalent								
12.	**Radar Signal Analysis Education and Research Lab Platform**	The lab is designed for radar signal analysis and is based on the SDR platform. The main features of the lab are outlined below: · 6 different laboratory works for in depth analyses of radar signal basics · Processing in presence of active and passive noises · Ability to generate 2 different objects, change time delay between objects · Following are functions that can be performed 1. Digital downconversion 2. Gaussian filter 3. Pulse compression 4. Digital upconversion List of Labs 1. Device for matched filtering and forming of the pulse signal with linear frequency modulation. 2. Device for forming and matched filtering of the pulse signal with pseudorandom phasemanipulation. 3. Device for formation and correlation processing of the pulse signal with a pseudo-randomly phase manipulation.	No	European/ American	3				

		4. Specialized Digital processor for processing non-coherent packets of radio pulses in the surveillance radars. 5. Digital quasi-optimal non-parametric detector with stabilization of the probability of false alarm by a modified sign detectors. 6. Device for digital detection of coherent packets of pulses on the presence of passive noises. **Hardware Specifications** · 10 MHz to 6 GHz Tunable RF Transceiver · Number of Tx and Rx channels 2 · Frequency range 10 MHz to 6 GHz · Frequency step <1 kHz · Maximum instantaneous real-time bandwidth 160 MHz · Maximum I/Q sample rate 200 MS/s · Digital-to-analog converter (DAC) Resolution 16 bit · Analog-to-digital converter (ADC) Resolution 14 bit · GPS disciplined clock included · Desktop connectivity included · Power supply and accessories included							

		Or Equivalent								
13.	**RF Power Meter**	· 18 GHz, -40 dBm to +20 dBm Power Range, RF Power Sensor Device · Wide dynamic range and high measurement accuracy packaged in a size similar to a typical power head. · A true RMS power meter, that should be ideal for making extremely accurate average power measurements of signals ranging from single-tone and multitoned sources to wideband, complex digital waveforms. · Highly suitable for mobile applications or adding to automated test applications to free up valuable rack space without sacrificing performance. · It can be hardware-triggered through an external trigger source or software-triggered based on the signal source. Scope and slot modes use this software triggering to measure burst waveforms, such as WiMAX and LTE, and multislot waveforms, such as GSM and EDGE. **Or Equivalent**	No	European/ American	3				
14.	**Ball and Beam System**	· High-quality aluminum chassis with precision-crafted parts · Robust machined aluminum casing with stainless steel rod · Ball and Beam module easily	No	European/ American	1				

		attaches to Rotary Servo Base Unit							
		· Optional Master/Slave configuration with additional Ball and Beam module							
		· Easy-connect cables and connectors							
		· Calibrationed base dimensions (L x W) 50 cm x 22.5 cm							
		· Beam length 42.55 cm							
		· Lever arm length 12 cm							
		· Support arm length 16cm							
		· Ball diameter 2.54 cm							
		· Ball mass 0.064 kg							
		· Ball position sensor bias power ±12 V							
		· Ball position sensor measurement range ±5 V							
		· Ball and Beam module mass 0.65 kg							
		· Affordable tool to teach and implement multiple design concepts with one device							
		· 10 analog inputs, 6 analog outputs, 40 digital I/O lines							
		· Wireless, LEDs, push button, accelerometer onboard							
		· FPGA and dual-core processor							
		· Fully programmable with LabVIEW or C; adaptable for different programming levels							
		Or Equivalent							

Special Instructions

Description	Bidder			Tech Scrutiny to be done by User		
	Yes	**No**	**Alternate Offer**	**Accepted**	**Rejected**	**Reasons of Rejection**
Environment Conditions (a) Temperature range: 05ºC to +60ºC (b) Relative humidity: 0-70% non-condensing						
Warranty period Two years from the date of commissioning. A warranty sticker is to be pasted on each imported item by the Supplier / OEM highlighting Name of Firm, Contract No and date, Description of Store and Warranty validity						
Training Notes Supplier will provide a set of handouts for training on operation and maintenance of the equipment						

Publications Supplier is to provide hard and soft copies (CD) of following manuals.
(a) **Operational / Maintenance manual**: - Qty 01 with Equipment and additional Qty 02 for record purposes and should consist of following sections:-
  (1)**Equipment Description /Operation**:-
        (a)Specifications
        (b)Description
        (c)Operation
  (2)**Servicing**:-
              (a)Maintenance Schedule
        (b)Adjustment / test
              (c)Removal / Installation procedure
        (d)Tools Used
  (3) Trouble shooting guide
  (4) Cleaning requirements
  (5) Shipping and receiving
  (6) Storage requirements
(b) **IPB** (Illustrated Parts Breakdown Manual) should have full parts description along with detailed diagrams (exploded view).
(c) **Experimental manuals** which must contain the list and procedure of the experiments that equipment can perform.						

Spares / Technical Support (a) Supplier to have in-country spares / technical support and ensure spares and technical support / assistance for next 10 years (b) Comprehensive list of spares required for scheduled maintenance of Equipment is to be provided (c) Any software provided must have its license (d) Software upgrade support must be provided free of cost for 10 x years with renewed license at every upgrade (e) Supplier must also provide calibration service for at least 5 x years after commissioning						

Additional Spare / Replaceable parts.
    (a)   Replaceable spare / parts during scheduled inspections are to be identified and provided as per requirement along with equipment sufficient to cater five years consumption.
    (b) All specialized / standard tools required for inspection / repair / servicing must be supplied along with equipment.						

Physical Inspection Criteria: 100% physical inspection of store will be carried out before commissioning of the equipment for following details:-
    (a) For physical damage, scratches and deformity.
 	
    (b)   Accessories /components as per contractual specifications.
 	
    (c)   Technical Manuals (Operation manual, user guide, IPBs).
 	
    (d)   Quality certificate and calibration certificate by the OEM
 	
    (e)   OEM certificate and verifiable documents by the supplier that store has been procured from certified source and is factory new and from latest production.
 	
    (f) Brand name and country of origin.						

Commissioning
    (a)   Commissioning of the equipment will be carried out by OEM rep at his own cost and risk at designated place at NUTECH.
    (b) Any special requirement for installation, operation and commissioning must be specified in the offer by the supplier.						

Training 01 week OEM operational/ maintaince training at NUTECH						
Improvement and Safety Measures Any improvement and safety measures suggested by NUTECH during commissioning are to be resolved by the supplier / manufacturer at no extra cost.						
Liability of Supplier (a) OEM certificate of authorized dealership Supplier is to provide original OEM certificate of subject equipment bought directly from the manufacturer and being an authorized dealer. (b) In case the equipment supplied is not compatible with specifications, the supplier will be obliged to call his representatives at his own cost for consultation and corrective action						
Special Notes (a) Additional requirements for the maintenance of equipment (if any) must be intimated by the supplier in technical offer. (b) Supplier must provide the list of organizations using same equipment in Pakistan (if any). (c) Equipment must be a standard product of OEM available at web address of OEM. (d) In case of premature failure of the equipment, OEM has to replace / rectify the item free of cost. Required transportation charges would be borne by the supplier.						

Firm Name_____
Signature_____
Name_____
Designation_____

NATIONAL UNIVERSITY OF TECHNOLOGY
SUPPLY CHAIN MANAGEMENT OFFICE

TECHNICAL OFFER

User Reference No **Elec Lab Eqpt-003**   Date: **29-04-2019**

Please fill in the following essential parameters:

1. Validity of Offer:_____ Days   (Should not be less than 90 days)
2. Delivery Period:_____ Days   (After Placement of order)
3. Country of Origin:_____
4. Warranty/Guarantee: _____ Months from the date of final acceptance of the stores.

General

GST No: _____ (Please enclose copy)

NTN/CNIC: _____ (if exempted, please provide valid exemption certificate)

Payment Terms: (Mandatory to mention) (Please tick/ mention the desired payment term/ mode)

1. 50 % advance payment (Against valid bank Guarantee)
2. 50% Payment after delivery, installation /commissioning, user satisfaction certificate

Details of Payment Recipient

(1)   Name/Title: _____

(2)   Address:_____

Signature: _____

Official Seal: _____

Name: _____

Designation: _____

FINANCIAL OFFER

<u>**Annex C**</u>

User Reference No <mark>Elec Lab Eqpt-003</mark>   Date: <mark>29-04-2019</mark>

Ser	Nomen/ Experiment	Description	A/U	Country of Origin	Qty Req	Unit Price (Rs) (excluding taxes)	All Taxes	Unit Pric incl all taxes (Rs)	Total Amount of Total Qty With all Tax (Rs)
1.	**FPGA based Embedded Design Device**	• 10 analog input channels, 6 analog outputs, 40 digital I/O lines • Wireless, LEDs, push button, accelerometer onboard • FPGA with dual-core processor • Fully programmable with LabVIEW or C; adaptable for different programming levels **Accessories include** • Driver and software evaluation DVDs • USB cable • Power supply with international adapters • 1 MXP protoboard accessory • Sensors and Actuators Kit • Barrel connector with leads • Capacitors, Diodes, Resistors, 7-segment display, op-amps, LEDs, Microphone with audio jack, Breadboard Accessory, Potentiometer 500 kΩ, Relays 16,	No	European / American	10				

		Piezoelectric sensor, Photocell, Photo interrupter (light sensor with LED), Hall effect sensors (latch and switch), Buzzer, • Small DC motor (1 VDC to 3 VDC, no load speed: 6600 rpm) • Assorted switches (DIP, slide, and rotary) • Thermistor (NTC: 10 kΩ, 25 degrees) • Assorted transistors • Force sensing resistor • Wire kit • Keypad • Digital temperature sensor (I2C) • Character LCD (I2C, SPI, and UART) • Digital potentiometer (SPI) • Bluetooth interface (UART) • EEPROM (SPI) • LED matrix • Geared motor 19:1 (includes encoder for rotation and speed, 12 V) • Ultrasonic range finder (accurate readings of 0 in. to 255 in. or 6.45 m) • Compass • Servo motor: standard (215 degrees rotation) • Servo motor: continuous rotation • Accelerometer (3 axis, digital - SPI and I2C) • H-bridge driver (compatible with gear motor) • Gyroscope (3 axis, digital - SPI and I2C) • Infrared proximity sensor (10							

		cm to 80 cm) • Ambient light sensor **Or Equivalent**							
2.	**Robotics Kit with embedded controller (Rover Vehicle, Balancing Arm, Self-Balancing Robot)**	• Fully programmable with embedded design device • Motor Board to connect all included sensors and actuators with ease • Battery Charger • Sensors and actuators: Standard Servo, 2 DC Motors, Ambient Light Sensor, Gyro Sensor, IR rangefinder • Camera for Image Processing • Ability to connect to robot sensors and actuators • Obstacle avoidance, mapping, and path planning • Inverse kinematics, JAUS, and simulation capabilities • Includes all the necessary mechanical and electrical parts as well as instructions to construct 3 robot models directly out of the box. • Rover Vehicle • Balancing Arm • Self-Balancing Robot **Or Equivalent**	No	European / American	10				
3.	**Digital Electronics and DLD Lab Platform with FPGA**	**Based Platform** • Seven hardware instruments plus control I/O containing 16 AI, 4 AO, and 40 DIO • 4-channel, 100 MS/s oscilloscope sample rate with 14-bit resolution and 50 MHz bandwidth • 16-channel, 100 MS/s logic	No	European / American	10				

		analyzer/pattern generator • 16-channel, 1 MS/s analog input with 16-bit resolution • 40 DIO lines individually programmable as input, output, PWM, or digital protocols **Add-On Board for Base Platform** • FPGA, programmable with Multisim and LabVIEW • 2.8 in. capacitive touch display • 8 LEDs, 8 slide switches, 4 push buttons, 4-digit 7-segment display • USB, Ethernet, and Micro SD card ports • Audio, VGA, and HDMI ports **Or Equivalent**							
4.	**Controls Trainer**	**Based Platform** • Seven hardware instruments plus control I/O containing 16 AI, 4 AO, and 40 DIO • 4-channel, 100 MS/s oscilloscope sample rate with 14-bit resolution and 50 MHz bandwidth • 16-channel, 100 MS/s logic analyzer/pattern generator • 16-channel, 1 MS/s analog input with 16-bit resolution • 40 DIO lines individually programmable as input, output, PWM, or digital protocols **Add on For Base Platform** • Highly linear brushed DC motor • Removable inertia load for variable dynamics • High-resolution optical encoder and current sense	No	European / American	10					

		• Optional pendulum attached • Highly Linear Motor Response to enable directly relational modeling and control design • Access and customize all levels of the interfacing and control software • Complete Package: Hardware and courseware enable courses to cover the essentials of introductory and advanced controls • Simulink Compatibility **Or Equivalent**							
5.	**Digital/Analog Communication Labs**	**Based Platform** • Seven hardware instruments plus control I/O containing 16 AI, 4 AO, and 40 DIO • 4-channel, 100 MS/s oscilloscope sample rate with 14-bit resolution and 50 MHz bandwidth • 16-channel, 100 MS/s logic analyzer/pattern generator • 16-channel, 1 MS/s analog input with 16-bit resolution • 40 DIO lines individually programmable as input, output, PWM, or digital protocols **Add on For Base Platform** Hardware Blocks: • 100kHz BPF • 150kHz LPF • Adder x 2 • Analog MUX • Comparator • I&D and I&H • Limiter • Master Signals	No	European / American	10				

		• Multiplier x 4 • Parellel/Serial • Phase Shifter • Precision Rectifier • RC LPF • RRC LPF x 4 • Sample and Hold • Generator x 2 • Speech • TLPF • VCO • X-OR • Oscilloscope 4ch, 100MS/s, 14bit • Function generator: 2ch, 100MS/s, 15MHz, 14bit • Logic analyzer 16ch, 100MS/s • IV analyzer: ±10 V, ±30 mA, 15 MHz • Digital Multimeter • Variable power supply: ±15 V, 500 mA • Processor FPGA • AI/AO: 16 ch, 16 bits/4 ch, 16 bits • DIO: 40ch • SFP Support: windows Mac, Web • Programming Language Support: LabVIEW, Python, C++ **Or Equivalent**							
6.	**DSP Kits**	**Multifunction DAQ device** • Compact, portable, and USB-powered device for use anywhere, anytime • Oscilloscope, DMM, Function Generator, Variable Power Supply,	No	European / American	10				

		Bode Analyzer, Dynamic Signal Analyzer, Arbitrary Waveform Generator, DIO,							
		• Single device provide 8 plug-and-play computer-based lab instruments							
		• Data acquisition engine with analog inputs/outputs and digital lines							
		• Extendable capabilities by programming with LabVIEW, C or MATLaB softwares							
		• Simulate and compare with Multisim SPICE software							
		DSP Kit							
		• Tool for hands-on learning of digital filters							
		• 50 MHz microchip DSP with anti-aliasing filters and reconstruction filters on the output							
		• 32-bit precision to create filters up to the 10th order							
		The included lab manuals provide exercises to support the student learning experience							
		Or Equivalent							
7.	**Wireless Communications Teaching Bundle with 2 x 2 MIMO**	• Software defined transceivers (2X2 MIMO, 70 MHz to 6 GHz) **Transmitter** Frequency range: 70 MHz to 6 GHz Frequency step <1 kHz	No	European / American	6				

		Maximum output power (Pout): 20 dBm						
		Gain range (The output power resulting from the gain setting varies over the frequency band and among devices): 89.75 dB						
		Gain step: 0.25 dB						
		Frequency accuracy (based on temperature-compensated crystal oscillator): 2.5 ppm						
		Maximum instantaneous real-time bandwidth: 56 MHz						
		Maximum I/Q rate						
		Streaming: 15 MS/s						
		Burst (One channel: 61.44 MS/s)						
		Burst (Two channel: 30.72 MS/s)						
		Digital-to-analog converter (DAC): 12 bits						
		Receiver						
		Frequency range: 70 MHz to 6 GHz						
		Frequency step <1 kHz						
		Gain range: 76 dB						
		Gain step: 1.0 dB						
		Maximum input power: -15dBm						
		Noise figure: 5dB to 7dB						
		Frequency accuracy: 2.5ppm						
		Maximum instantaneous real-time bandwidth: 56 MHz						
		Maximum I/Q rate						
		Streaming: 15MS/s						
		Burst(One channel: 61.44MS/s)						
		Burst(Two Channel: 30.72MS/s)						

		ADC: 12 bits **Power** Typical: 3W to 3.5W Maximum 4.5W Power requirement: accepts a 6V, 3A external DC power connector • Covers FM radio, GPS, GSM, Bluetooth, and ISM bands • Up to 56 MHz bandwidth with USB 3.0 connectivity **Accessories** • 2 x Power Supplies • 2 x 144 MHz, 400 MHz, 1200 MHz , Tri Band Vertical Antenna • 2 x 824-960 MHz, 1710-1990 MHz Dual-band Vertical Antenna **Or Equivalent**							
8.	**Spectrum Analyzer and High Frequency Waveform**	Consists of RF Transceiver Module and Embedded Controller A). 100 MHz Bandwidth RF Transceiver Adapter Module · RF TX and RX with shared LO · 200 MHz to 4.4 GHz frequency range · 100 MHz instantaneous bandwidth · LO input and output for MIMO synchronization · 12 bidirectional general-purpose digital I/O channels B). Embedded Controller for RF Transceiver · DSP-focused Xilinx Kintex-7	No	European / American	1				

		K325T FPGA programmable with the LabVIEW, C or MATLAB FPGA Module · 2 GB onboard DDR3 DRAM · Dual-core processor running Linux Real-Time **Or Equivalent**							
9.	**Test and Measurement Hardware for Microwave and Antenna**	· 70 MHz to 6 GHz, 2-Channel Software Defined Radio Device · Tunable RF transceiver with full-duplex, MIMO operation. · It offers bus-powered connectivity with USB 3.0 or USB 2.0. · Can also be used for following communications applications: white space; broadcast FM; public safety; land-mobile, low-power unlicensed device (ISM) bands; sensor networks; amateur radio; or GPS **Or Equivalent**	No	European / American	6				
10.	**PCB Antennas Lab Trainer**	· PCB antennas lab is a complete training program for the study of the basic principles of antennas, their species, features and signal transmission basics. · The system is used in the educational process to familiarize the user with the parameters of antennas and practical training for antenna measurements. · Laboratory course is designed to gain knowledge in the following areas: o Theory fundamentals	No	European / American	6				

		o Antenna parameters							

o Antenna parameters

o Measurement of antenna parameters

· With the use of the software, the students have the opportunity to make measurements with subsequent visualization of the test results in the form of graphs.

List of Labs

Study of varieties of antennas

1. Sleeve monopole antenna

2. Trapezoidal monopole antenna

3. G, L, T monopole antennas

4. Dual-band monopole antenna

5. Printed folded dipole antenna

6. Log-periodic antenna

7. Sierpinski bow-tie antenna

8. Micro strip - fed Vivaldi antenna

Study of main parameters of antennas

9. Directional response

10. Gain

11. Voltage Standing-Wave Ratio (VSWR)

12. Reflection index

13. Antenna input resistance

14. Half-Power Beam Width (HPBW)

15. First-Null Beam Width (FNBW)

Antennas main characteristics' comparison

		Measurement results' comparison with theory **Or Equivalent**							
11.	**Microwave Experiment Kit**	· An complete experimental equipment to educate Microwave Component Design, Manufacturing, and Measuring techniques include Microstrip line theory and Microwave device design theory Study the mocristrip line design theory Study the basic theory of microwave component Microwave component design & simulation Microwave component manufacturing Microwave component measurement Microwave component analysis of characteristics **Or Equivalent**	No	European / American	6				
12.	**Radar Signal Analysis Education and Research Lab Platform**	The lab is designed for radar signal analysis and is based on the SDR platform. The main features of the lab are outlined below: · 6 different laboratory works for in depth analyses of radar signal basics · Processing in presence of active and passive noises · Ability to generate 2 different objects, change time delay between	No	European / American	3				

		objects							
		· Following are functions that can be performed							
		1. Digital downconversion							
		2. Gaussian filter							
		3. Pulse compression							
		4. Digital upconversion							
		List of Labs							
		1. Device for matched filtering and forming of the pulse signal with linear frequency modulation.							
		2. Device for forming and matched filtering of the pulse signal with pseudorandom phasemanipulation.							
		3. Device for formation and correlation processing of the pulse signal with a pseudo-randomly phase manipulation.							
		4. Specialized Digital processor for processing non-coherent packets of radio pulses in the surveillance radars.							
		5. Digital quasi-optimal non-parametric detector with stabilization of the probability of false alarm by a modified sign detectors.							
		6. Device for digital detection of coherent packets of pulses on the presence of passive noises.							
		Hardware Specifications							

		· 10 MHz to 6 GHz Tunable RF Transceiver							
		· Number of Tx and Rx channels 2							
		· Frequency range 10 MHz to 6 GHz							
		· Frequency step <1 kHz							
		· Maximum instantaneous real-time bandwidth 160 MHz							
		· Maximum I/Q sample rate 200 MS/s							
		· Digital-to-analog converter (DAC) Resolution 16 bit							
		· Analog-to-digital converter (ADC) Resolution 14 bit							
		· GPS disciplined clock included							
		· Desktop connectivity included							
		· Power supply and accessories included							
		Or Equivalent							
13.	**RF Power Meter**	· 18 GHz, -40 dBm to +20 dBm Power Range, RF Power Sensor Device · Wide dynamic range and high measurement accuracy packaged in a size similar to a typical power head. · A true RMS power meter, that should be ideal for making extremely accurate average power measurements of signals ranging from single-tone and multitoned sources to wideband, complex digital waveforms. · Highly suitable for mobile	No	European / American	3				

		applications or adding to automated test applications to free up valuable rack space without sacrificing performance.							
		· It can be hardware-triggered through an external trigger source or software-triggered based on the signal source. Scope and slot modes use this software triggering to measure burst waveforms, such as WiMAX and LTE, and multislot waveforms, such as GSM and EDGE.							
		Or Equivalent							
14.	**Ball and Beam System**	· High-quality aluminum chassis with precision-crafted parts	No	European / American	1				
		· Robust machined aluminum casing with stainless steel rod							
		· Ball and Beam module easily attaches to Rotary Servo Base Unit							
		· Optional Master/Slave configuration with additional Ball and Beam module							
		· Easy-connect cables and connectors							
		· Calibrationed base dimensions (L x W) 50 cm x 22.5 cm							
		· Beam length 42.55 cm							
		· Lever arm length 12 cm							
		· Support arm length 16cm							
		· Ball diameter 2.54 cm							
		· Ball mass 0.064 kg							
		· Ball position sensor bias power ±12 V							

· Ball position sensor measurement range ±5 V · Ball and Beam module mass 0.65 kg · Affordable tool to teach and implement multiple design concepts with one device · 10 analog inputs, 6 analog outputs, 40 digital I/O lines · Wireless, LEDs, push button, accelerometer onboard · FPGA and dual-core processor · Fully programmable with LabVIEW or C; adaptable for different programming levels **Or Equivalent**								
		TOTAL					

Bid Bond Ref_____ GST_____

Total Value Incl all taxes_____

(Bid Bond be attached with Annex C. Copy of Bid Bond be attached with

Technical offer without showing its value) . Exposure of Bid Bond value in tech offer will result in rejection of offer

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Signature_____
Name_____
Designation_____