1. **The specifications of laboratories equipment for the Department of Electrical Engineering has been revised/updated in light of the Pre-bid Meeting held on 10.06.2021 and are given below:CONTROL LAB**

Item	Qty.	Description
1	1	**Data-/Video projector** Light intensity: 3000 ANSI Resolution: WXGA 1280 x 800 3LCD, 3 chip technology White Light Output: 3,000 ANSI lumens Color Light Output: 3,000 ANSI lumens Colors: 16.7 million colors Aspect Ratio: Native 16:10 and 4:3 / 16:9 compatible Contrast Ratio: 3000: 1 (using active IRIS) Throw Ratio (distance: width): 1.5 - 1.8 : 1 Cloning Function, ImageCare Technology, Intelligent Eco and Saver Modes, PC-Less Presentation, PIN Lock / MyScreen / MyText, PJMessenger, Present Content via LAN, Display via USB, Microphone Input, Network Control, Maintenance and Security, Serial Number and Media Access Control Label **Screen Rollo** - for wall and ceiling suspension - black with photoresist back side - lockable in different positions for different screen-sizes - housing, colour white - W = 1800 mm, H = 1800 mm
2	6	**Component and Cable Holder** movable with utility tray. W = 600 mm, D = 600 mm, H = 1600 mm

	10		**Process Control Trainer**
			Training system for process-oriented control engineering
			Integrated controllers:
			P-controller
			I-controller
			D-controller
			PI-controller
			PD-controller
			PID-controller
			Level control/Flow controller
			Temperature control
			Light control
			Motor / generator system
			Position control
			Speed control
			Step manipulation for three-level controller
			Set of connections for Process Control trainer
			4 measuring leads 2mm, length 30 cm, yellow
			3 measuring leads 2mm, length 60 cm, black
			The required quantity is 1 for following components of Item number 3.
			Set of ring binders
			consisting of:
			-Ring binder for printed media
			with dividers for the following sections:
			- Trainer section
			- Practical experiments
			- Expert publications
			- **Ring binder for digital media**
			Manual, incl. CD-ROM
			"Control engineering"
3			Edition for trainees / students

		Manual, incl. CD-ROM
		"Control engineering"
		Edition for the teacher / trainer with solutions
		Techno Card
		One quantity for each module of Process Control trainer
	10	**Digital Real time Storage Oscilloscope**
		40 MHz, 2 channels, color TFT display, USB interface
		500 GS/s Sample Rate on All Channels
		inlc. two (2) 100 MHz 10X passive probes
		Set of BNC measuring leads and adapters
4		3 pcs. BNC measuring leads, 100 cm, black

MICROCONTROLLER LAB

Item	Qty.		Description
1	1		**Data-/Video projector**
			Resolution: UHD (3840x2160) Brightness: 3,400 lumens Contrast ratio: 500,000:1 Native aspect ratio: 16:9 Aspect ratio - compatible: 4:3 Keystone correction - vertical: +/-40° Horizontal scan rate: 31 ~ 135Khz Vertical scan rate: 24 ~ 120Hz Uniformity: 80% Screen size: 34.1" ~ 302.4" diagonal Lamp life hours (up to): 4000 (Bright), 15000 (Dynamic), 10000 (Eco) Throw ratio: 1.21:1 ~ 1.59:1 Projection distance (m): 47.24" - 318.9" Power supply: 100 ~ 240V, 50 ~ 60Hz
2	1		**Screen Rollo**
			- for wall and ceiling suspension
			- black with photoresist back side
			- lockable in different positions
			for different screen-sizes
			- housing, colour white
			- W = 1800 mm, H = 1800 mm
		-	Components of integrated development environments
		-	DC and stepper motor control
3	10		**Microcontroller Trainer System**
			The Microcontroller Trainer System is the basic module of the microcomputer training system. It has the following features and functions:
			ON/OFF switches
		8	pushbuttons
		8	interrupt output
		1	7-segment displays
		4	heating module
		1	I^{2}C temperature sensor
		1	I^{2}C real time clock

		1	I²C ambient light sensor
		1	I²C LC display with back light
		1	analog pressure sensor up to 5 bar
		1	analog temperature sensor up to 100°C
		1	bipolar stepper motor, 0.9° incremental motion
		1	DC motor with motor drive and speed sensor
		1	speaker
			Adjustable DC voltage level: 0 … TTL level
			Function generator 50 Hz … 10 kHz, TTL level
			BNC socket for adapting measuring instrument inputs to 2 mm connections
		1	Plug-in field for programming modules
		2	Plug-in fields for expansion modules
			Technical data:
			- Computer interface via Ethernet
			- 2 mm connectors or bus connectors (8-pin 1:1, ribbon cable)
			- Power supply 110 … 240 V AC, 50 … 60 Hz
			- Internal operating voltage 3.3 V; 5,0 V; +/-12 V
			- Logic level 3.3 V or 5 V
			- Power cord with device plug
			- Central on/off switch
			Design:
	10		**PIC16F84A Microcontroller**
			The "**PIC16F84A Microcontroller**" is an integrated test and programming module for the Microcontroller Trainer System. It has the following function elements and parameters:
			ZIF socket, 18-pin, for inserting the controller PIC16F84A (PIC16F84)
		-	Controller PIC16F84A
		-	Clock generation with quartz 4MHz
		-	Ports A (0 … 4) and ports B (0 … 8) have 2 mm connectors, ports B bus connectors in addition
		-	LED per port pin indicating the logic level
	10		**10 Bit ADC**

			The "10 Bit ADC" is an integrated test and programming module for the Microcontroller Trainer System. It has the following technical parameters:
			2-channel AD converter
		-	Reference voltage 1V
		-	Differential inputs with 2mm sockets
		-	Outputs on 2 mm sockets and bus connectors
		-	Logic level: +3.3 V or +5 V depending on the setting of the programmer module
		-	Dimensions 78 mm x 95 mm x 32 mm
	10		**Set of measuring leads 2mm**
			consisting of:
		8	measuring leads 2mm, length 15 cm, yellow
		8	measuring leads 2mm, length 30 cm, black
		4	measuring leads 2mm, length 45 cm, yellow
		4	measuring leads 2mm, length 45 cm, blue
		2	measuring leads 2mm, length 45 cm, red
	1		**Manual, incl. CD-ROM**
			"Microcontroller technology PIC16F84"
			Edition for trainees / students
		-	Description of theory and guided practical experiments
		-	Unrestricted copying license for educational institutions
		-	Greyscale print
		-	*Contents:*
			1. Introduction to the Technology of Microcomputers
			Introduction
			Microcontrollers
			Embedded Systems
			The Instruction Set of a CPU
			The Memory Components in a Microcontroller
			Ports – "the Door to the Outside World"
			Timer – the Timing Device in a Microcontroller
	1		**Manual, incl. CD-ROM**

			"Microcontroller technology PIC16F84"
			Edition for the teacher / trainer **with solutions and method leads**
		-	Description of theory and guided practical experiments
		-	Unrestricted copying license for educational institutions
		-	Colour print
		-	**inkl. documentation of the components**
	1		**Manual, incl. CD-ROM**
			"Microcontroller technology PIC16F84"
			Part 2: Extended periphery
			Edition for trainees / students
		-	Description of theory and guided practical experiments
		-	Unrestricted copying license for educational institutions
		-	Greyscale print
			Contents:
			1. Analog Digital Converter with SPI Interface
			Programming the SPI to the ADU AD7911
			Testing the SPI
			Progress Test
			2. The I²C Bus
			The LC-Display, EA T123-I2C
			Static Character Output to the I²C LC-Display
			3. Measuring Analog Values
			Measurement and Display of a changing DC Voltage
			Scaling the Measured Value
			Temperature Measurement with an Analog Temperature Sensor
			Pressure Measurement with an Analog Pressure Sensor
			Progress Test
			4. The Intelligent Temperature Sensor LM75
			Registers of the LM75
			Data Transfer from the LM75

			Progress Test
			5. Real Time Clock
			Internal Structure of the Real-time Clock, DS1338
	1		**Manual, incl. CD-ROM**
			"Microcontroller technology PIC16F84"
			Part 2: Extended periphery
			Edition for the teacher / trainer **with solutions and method leads**
		-	Description of theory and guided practical experiments
		-	**inkl. documentation of the components**
	1		**TechnoCard**
			PIC16F84A
	1		**TechnoCard**
			How to use the Microcontroller Trainer System.
	1		**TechnoCard**
			The integrated development environment
			MPLAB from Microchip
	1		**Manual, incl. CD-ROM**
			"Voltage measurement and display"
			Edition for trainees / students
		-	Instructions for project work with theoretical explanations and prepared documentation
		-	Unrestricted copying license for educational institutions
		-	Greyscale print
		-	*Contents:*
			1. Project Task Description
			Introduction
			Project Task
			Progress Test
			2. Analysis and Outline Structure
			General Conclusions from the Task Description
	1		**Manual, incl. CD-ROM**

			"Voltage measurement and display"
			Edition for teachers / trainers **with solutions**
		-	Instructions for project work with theoretical explanations and prepared documentation
		-	Unrestricted copying license for educational institutions
	1		**TechnoCard**
			Voltage measurement and display
			Experiments with PIC16F887 controller
	10		**PIC16Fxx Programmer**
			The PIC16F8xx Programmer is an integrated test and programming module for the Microcontroller Trainer System. It has the following function elements and parameters:
			ZIF socket, 40-pin, for inserting the controllers PIC16F887, 884 or 877, 874
		-	Controller PIC16F887
		-	Clock generation up to 8 MHz internal or with quartz 16 MHz
		-	Port A, port B, port C, port D and port E have 2 mm connectors, ports B, C and D have bus connectors in addition
	1		**Manual, incl. CD-ROM**
			"Programming with the microcontroller PIC16F887"
			Edition for trainees / students
		-	Description of theory and guided practical experiments
		-	Unrestricted copying license for educational institutions
			The Memory Components in a Microcontroller
			Ports - "the Door to the Outside World"
			Timer - the Timing Device in a Microcontroller
			Progress Test
			2. Programming a Microcontroller
			Basic Concepts of Compiling Programs
			Introduction to the Integrated Development Environment MPLAB®
			Creating C-Projects
			Loading the Program in the PIC16F887
	1		**Manual, incl. CD-ROM**

			"Programming with the microcontroller PIC16F887"
			Edition for the teacher / trainer **with solutions and method leads**
		-	Description of theory and guided practical experiments
		-	Unrestricted copying license for educational institutions
		-	Colour print
			inkl. documentation of the components
	1		**Manual, incl. CD-ROM**
			"Programming with the microcontroller PIC16F887"
			Part 2: Extended periphery
			Edition for trainees / students
		-	Description of theory and guided practical experiments
		-	Unrestricted copying license for educational institutions
		-	Greyscale print
	1		**Manual, incl. CD-ROM**
			"Programming with the microcontroller PIC16F887"
			Part 2: Extended periphery
			Edition for the teacher / trainer **with solutions and method leads**
		-	Description of theory and guided practical experiments
		-	Unrestricted copying license for educational institutions
		-	Colour print
		-	**inkl. documentation of the components**
	1		**TechnoCard**
			How to use the Microcontroller Trainer System
	1		**TechnoCard**
			Microcontroller PIC16F887
	1		**TechnoCard**
			The special functions register of the PIC16F887
	10		**ATmega microcontroller**
			The "**ATmega microcontroller"** is an integrated test and programming module for the Microcontroller Trainer System. It has the following function elements and parameters:

			ZIF socket, 40-pin, for inserting the controllers ATmega16, 32 or 8535
		-	Controller ATmega16
		-	Clock generation 1, 2, 4, 8 MHz internal or with quartz 10MHz
		-	Port A, port B, port C and port D (0 … 8) have 2 mm connectors, ports B and C have bus connectors in addition
		-	Integrated ADC (port A), 8 channels, 10 bits
		-	On chip debugging interface JTAG and debug wire
		-	LED per port pin indicating the logic level
		-	Programmer circuit, in series, ISP
			Included in delivery:
	1		**Manual, incl. CD-ROM**
			"Microcontroller technology ATmega16"
			Edition for trainees / students
		-	Description of theory and guided practical experiments
		-	Unrestricted copying license for educational institutions
		-	Greyscale print
		-	*Contents:*
			<u>1. Introduction to the Technology of Microcomputers</u>
			Introduction
			Microcontrollers
			Embedded Systems
			The Instruction Set of a CPU
			The Memory Components in a Microcontroller
			Ports - "the Door to the Outside World"
			Timer - the Timing Device in a Microcontroller
			Progress Test
			<u>2. Programming a Microcontroller</u>
			Basic Concepts of Compiling Programs
			Introduction to the Integrated Development Environment AVR Studio®
			Progress Test

			3. The Microcontroller ATmega16
			Project 03: Timer and Interrupt
	1		**Manual, incl. CD-ROM**
			"Microcontroller technology ATmega16"
			Edition for the teacher / trainer **with solutions and method leads**
		-	Description of theory and guided practical experiments
		-	Unrestricted copying license for educational institutions
		-	Colour print
			inkl. documentation of the components
	1		**Manual, incl. CD-ROM**
			"Microcontroller technology ATmega16"
			Part 2: Extended periphery
			Edition for trainees / students
		-	Description of theory and guided practical experiments
		-	Unrestricted copying license for educational institutions
		-	Greyscale print
	1		**Manual, incl. CD-ROM**
			"Microcontroller technology ATmega16"
			Part 2: Extended periphery
			Edition for the teacher / trainer **with solutions and method leads**
		-	Description of theory and guided practical experiments
		-	Unrestricted copying license for educational institutions
		-	Colour print
		-	**inkl. documentation of the components**
	1		**TechnoCard**
			The ATmega16 controller
	1		**TechnoCard**
			The AVR instruction set
	1		**TechnoCard**
			The Atmel integrated development environment AVR Studio

				Microcontroller Training kit
	10			**Universal Logic Module**
				The Universal Logic Module is an integrated expansion module for the Microcontroller Trainer Application Board with the following
				4 ZIF sockets (free wiring of all pins via 2mm sockets), of which
				2 x ZIF socket, 14 pins
				1 x ZIF socket, 16 pins
				1 x ZIF socket, 20 pins
			-	8xLED with separate inputs for logic level indication; buffered
			-	4x pull-up resistor 10kohm
			-	Logic level: +5V TTL
			-	Operating voltage short-circuit-proof, $I_{max} \leq 1.3A$
			-	Overload indication by light blue LED
				Display (LCD) section 16X2.
				Multiplexed 4 seven segment display.
				Input switches push button 4 Bit section.
				One Reset push button.
				2 channel (isolated with op-to coupler) Relay interface section.
				Buzzer section peripherals.
4	10			**Basic set of logic ICs**
				Component set in robust assortment box made from unbreakable plastic with 18 compartments and 26 circuits
				2 pcs. 4xNAND gate, each with 2 inputs
			-	2 pcs. 2xNAND gate, each with 4 inputs
			-	2 pcs. 2xAND gate, each with 4 inputs
			-	2 pcs. 4xNOR gate, each with 2 inputs
			-	2 pcs. 4xOR gate, each with 2 inputs
			-	2 pcs. 4xXOR gate, each with 2 inputs
			-	2 pcs. 6xinverter
			-	2 pcs. 2xD-flipflop
			-	2 pcs. 2xJK-flipflop

5	10		PIC32MX1xx/2xx DIP Chips
6	10		PICKIT 3 Programmer
7	10		Crystal Resonators Oscillator Assortment Kit
8	10		PiezoBuzzer 12V
9	10		25LC512 EEPROM 512 Kb DIP Package
10	10		USB to Serial TTL Chip
11	10		1/4W Metal Film Resistors Assorted Box Assortment Kit (1 ohm to 1M ohm)
12	10		Ceramic Capacitor Kit (n to uF range)
13	10		Ceramic Capacitor Kit (pico to nF range)
14	10		Jumper Wire Kit
15	10		3 to 11k ohm CdS Photocell
16	10		2.4 inch TFT LCD MODULE
17	10		Large size solderless breadboards
18	10		ISP programmers
19	10		16X2 LCD
			Laboratory computer network
20	1		Preconfigured
			consisting of:
			Hardware
		12	student workstations (Core i7 10th generation, 16GB RAM, 256GB SSD, 1TB HDD. Motherboard integrated with wifi device. 24'' LED, keyboard and mouse)
		1	teacher workstation (Core i7 10th generation, 16GB RAM, 256GB SSD, 1TB HDD. Motherboard integrated with wifi device. 24'' LED, keyboard and mouse)
		1	Network cabinet (EIA standard 19'' with 450mm depth cabinet with 12U of rack space includes enclose lock and fan)
		1	Data Airbag Recovery Network Manager with supporting license
			Hard disk management for automatic distribution license

3. HIGH VOLTAGE LAB

Country of origin (Revised)

Germany, Sweden, USA, Canada, Australia, Austria, Belgium, France, Switzerland, Hungary, Italy, Spain.

High Voltage Kit System

1. Rated Voltage: 100 kV AC, 135 kV DC, and 135 kV Impulse

2. Additional High Energy Impulse System 300kV/15kJ **(Optional)**

Items of the high voltage Kit System

- Test transformer (Oil filled)
  a. Primary voltage: 220 V
  b. Secondary AC voltage: 100 kV
  c. Power Frequency: 50 Hz
  d. Rated continuous operational power: 5 kVA or above

Note: The exciting, compensation and high voltage windings of the test transformer shall be designed in a way that supports the cascaded operation and the internal PD level of the test transformer must be very low.

- Power control unit with stepless regulating transformer
- Capacitive voltage divider for AC and impulse voltages
- Resistive voltage divider for DC voltage measurement
- Set of resistances for switching impulse voltage
- Set of resistances for lighting impulse voltage
- Wave tail resistors for both lightening and switching voltages
- Partial discharge measurement devices **(Optional)**
- High voltage capacitors (1nF, 10 nF, etc.)
- High voltage resistors set
- High voltage rectifier
- High voltage blocking impedance
- Triggering spark gaps
- Impulse transient recorder or measurement module. A transient recorder will be very helpful while generating impulse voltages and evaluating during commercial testing as
  per IEC / IEEE standards.
- Peak voltmeter for AC and DC voltage measurements
- AC and DC current measuring devices

- Set of connecting and insulating elements
- Set of discharging rods
- Set of aluminum electrode plates to avoid field distortions at junctions
- Standard measuring sphere gaps for direct measurement of AC, DC, and Impulse voltage ($V50$) as per IEC 60052/2002 or IEC 60060/2010.
- Oil testing vessel as per international standards (IEC, VDE, etc.)
- Safety cage (with door) system as per international standards
- Operating computer with software, control and test recording features
- Modular elements storage trolleys

Clarification of Administrative Queries:

1. For the supply of lab Equipment**,** registration of the firms with Khyber Pakhtunkhwa Revenue Authority (KPPRA) is not mandatory, wherein, in the tender notice published on 26.05.2021 in daily "Mashriq" and "The News" it was mentioned that the firms are required to be registered with the Khyber Pakhtunkhwa Revenue Authority (KPPRA) which may be considered as discarded.

2. On Page No.14, Section 50.1 and 50.2 may be considered as discarded and payment to the firms will be made as per standard procedure of the Letter of Credit (L.C).

3. In page No.15, Section 12, the currency mentioned "PKR" may be read as "Foreign Currency".