Section VI. Schedule of Requirements

The delivery schedule expressed as weeks/months stipulates hereafter a delivery date which is the date of delivery to the project site.

Item No.	Descriptions	QTY	Unit	Delivery, Weeks/Months
1	**Electronic Circuit Design and 3D Simulation Software (20 users)** Features and Capabilities: 1. Schematic Editor 2. Schematic Symbol Editor 3. Footprint Editor 4. Netlist Editor 5. Live 3D Breadboard Tool 6. Advanced PCB Designer a. Automatic and Manual Design Tools b. Creating flex PCB's c. Animated 3D view 7. Electrical Rules Check(ERC) 8. Interpreter 9. Library Manager 10. Parameter Extractor 11. Text and Equation Editor 12. DC analysis 13. Transient Analysis 14. Fourier analysis 15. Digital Simulation 16. HDL Simulation (VHDL, Verilog, Verilog-A, Verilog-AMS) 17. Microcontrollers (MCU) Simulation a. MCU Simulation and Debugging AVR, 8051,8085,HCS, ARM) b. Linux and Android Simulation (ARM) c. Mixed Spice Simulation (Berkely and Xspice) 18. Flowchart Editor and Debugger 19. AC analysis 20. Network analysis 21. Noise analysis 22. Symbolic analysis 23. Monte-Carlo and Worst-case analysis 24. Design Tool 25. Optimization 26. Post-processor 27. Presentation 28. Interactive mode 29. Virtual Instruments a. Digital Multimeter b. Function Generator	**20**	**Users**	**60 Calendar Days**

	c. Storage Oscilloscope d. Signal and Network Analyzer e. Digital Signal Generator f. Logic Analyzer 30. Real-time Test & Measurements 31. Training and Examination a. Learning Management Tool – Simulator's Training Supervisor b.Teach and Lear Troubleshooting c. Problem Solving d. 1200 circuits and Integrated E-Books COMPONENT MODELS INCLUDED IN THE SOFTWARE: 1. Passive components a. Resistor b. Potentiometer c. Thermistor d. Lamp e. Capacitor f. Lossy capacitor g. Charged capacitor h. Inductor i. Energy-storing j. Inductor k. Coupled Inductors l. Non-Linear coil m. Transformer n. Relay o. Diodes(including Zener, Multi-color LED, Varicap, Schottky, Graetz, diode arrays) p. Motor q. Transmission Line r. Fuse 2. Active components a. Bipolar transistor (NPN and PNP) b. Darlington transistor c. MOS transistor (including BSIM3 models) d. JFET (N and P channel) e. IGBT f. Thermistor g. Thyristor h. Triac i. Diac j. Ideal or nonlinear k. Operational amplifier l. Transient and average SMPS models m. Manufacturer made Spice models n. Optoelectronic components			

	(photodiode, phototransistor, solar cell, optocoupler) 3. Sources a. Current source b. voltage source c. current generator d. voltage generator e. standard and arbitrary user-defined waveforms f. PWL g.WAV file h. Linear and nonlinear controlled sources (CCCS, VCCS, CCVS, VCVS) i.Digital pulse source, digital clock 4. Basic digital components a. AND b. OR c. NAND d. NOR e. XOR gates with 2, 3 and 4 inputs f. Buffer g.Tri-state buffer h. Inverter i. Schmitt j. Inverter k.D flip-flop l. SR flip-flop m.K flip-flop n. D latch 5. Digital IC a. MCU(PIC, AVR, ARM, 8051) b. 4000 logic family c. 74000 logic family d. VHDL to test and build your own logic components e. FPGA and CPLD libraries 6. Measuring Instruments a. Voltage meter b. Voltage pin c. Test point (for real time measurement) d. Ampere meter e. Current arrow f. Power meter g. Impedance meter 7. Other components a. Time controlled switch b. Voltage controlled switch c. AD and DA converter d. Timer e. Comparators f. Analog control blocks			

	g. Pull-up resistor h. Seven-segment display i. Keypad j. Voltage regulator k. Vacuum tube l. Passive and active RF components m. Two ports (S, Z, Y H) Minimum hardware and software requirements 1. Intel Pentium or equivalent processor or above 2. atleast 1 GB of RAM or higher 3. atleast 300 MB of available hard disk space 4. CD-ROM (in case of CD ROM installation) 5. Mouse or touchpad 6. VGA adapter card and monitor 7. Microsoft Windows 9x/ ME/ NT/ 2000/ XP / Vista/ Windows 7 Windows 8/Windows 10 8. Supported Networks (for Network versions): MS Windows 2000/2003/2008/2012 server or later, Linux Server, Novell Netware versions 3.12 or later			
2	**Electronic Application Trainer** The training shall be a complete tutorial board in the study of Arduino programming and applications. The training kit shall have the following technical specifications: 1. Power Supply (Built-in), · Input: AC 110/220V, 50/60Hz · Output : +5V/1.5A, +3.3V/0.5A · Surface Mounted LED for power indicator · 33uH Surface Mounted Inductor · Mounted 1x8 Female Dupont Connecto3 x3 · Mounted LOW-Drop Voltage Regulator (LD1117A) for power regulation · Surface Mounted 2.5A 16V F250L Self recovery fuse-in · Surface Mounted 1N5822 · DC/DC converter IC (AP1501) · Mounted 16v 330uF Capacitor x3 2. 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	**3**	**Units**	**60 Calendar Days**

7

	· Programming Interface: USB Type-B · With mounted parallel Female Dupont connector for upgrade module 3. Input Module Digital Input · x4 Key Pad: o tact switch button with HIGH initial state o Mounted 1x8 female Dupont connector for controls o Network Resistor Array (10K , 9pins) · DIP Switch 8bits: o Mounted 1x8 female Dupont connector for controls o Network Resistor Array (10K , 9pins) Analog Input · Slide Potentiometer: o 20KΩ x 2 o Mounted 1x2 female Dupont connector for controls · Joystick x 1 : o Vertical, Horizontal and Middle Button o Mounted 1x3 female Dupont connector for controls · Microphone x 1 : o Mounted Dual OP-Amp (LM358) o Surface Mounted Resistors: 1k, 10k, 3.3k,47k o Mounted Female Dupont Connector for controls Sensor Input · CDS Sensor x 1 : with Mounted Female Dupont Connector for controls · Temperature & Humidity Sensor x 1: with Mounted 1x2 female Dupont Connector for controls · Accelerometer: 3-axis, with mounted 1x5 Female Dupont Connector for controls · Ultrasonic Sensor x 1: with mounted 1x2 Female Dupont Connector for controls · Infrared transmitter & receiver x 3: with Mounted 1x3 Female Dupont Connector for IR LINE Tracer controls 4. Output Module · LED Matrix Display: o 8x8 o driver IC (ULN2803A,74HC138, 4801) o 10k surface mounted resistor x8 o 100 Ohms surface mounted resistor x8 o mounted 1x4 and 1x8 Female Dupont Connector for controls · 4-Digit 7-Segment Display: o Common-Anode o Driver IC (4801 x2), o 150 Ohms surface mounted resistor x9,			

	o 10K surface mounted resistor o Mounted 1x5 and 1x8 Female Dupont connector for controls · LED Bar: o 10 bits (Common-Anode) o 1x10 Female Dupont connector for controls · RGB LED x 4: o Driver IC (4801 x2) o 10k surface mounted resistor x4 o 1k surface mounted resistor x3 o Mounted 1x8 Female Dupont connector for controls · High Power LED x1: o 1W (Common-Anode) o Driver IC (4801) o 560 ohms 1/2W resistor o 10K surface mounted resistor o Mounted 1x2 female Dupont connector for controls · Serial RGB LED x 20: o 1x1 DIP switch for power o 0.1uF surface mounted Capacitor o Mounted 1x2 Female Dupont connector for controls · LCD Display 16x2 (serial and Parallel Control): o Mounted 1x11 Female Dupont connector for parallel control o Mounted 1x2 Female Dupont connector for Serial Control o Mounted 1bit DIP switch for Power o Mounted IC Driver (PCF8574 Remote 8-Bit I/O Expander) for Serial Control o Surface Mounted resistors for serial connection: 150 Ohms, 2K, 10K, 1.8K x2 o Surface Mounted 10K Trimmer Potentiometer · Relay: 5V, x2 o Driver IC (4801) o Surface mounted Diode for protection o Surface Mounted LED for triggered indicator o Resistors: 470 Ohms x2, 10K Ohms x2 · DC Motor : 5V, x2 o Surface Mounted Motor Driver IC (L293D). o 4.7K Ohms Surface Mounted Resistor x2 o 1N4001 Surface Mounted Diode x8 o Mounted 1x6 Female Dupont connector for controls · Step Motor : 12V, 7.5 deg / tick o Surface Mounted Motor Driver IC (L293D) o 4.7K Ohms Surface Mounted Resistor x2 o Mounted 1x62 Female Dupont connector for Comm controls			

	o Mounted 1x6 Female Dupont connector for step controls o Mounted 2bit DIP Switch for power · Servo Motor : 4.8V~6V , x 2 o 4.7K Ohms Surface Mounted Resistor x2 o Mounted 1x2 Female Dupont connector for controls o Mounted 1x6 Male Dupont connector for motor control · Electromagnetic Buzzer x 2 o Surface Mounted FET x2 o Mounted 1x2 Female Dupont connector for control o Surface Mounted Resistor 1.8K 5. Communication Module · Wi-Fi: ESP8266 x 1 o Mounted 1x4 and 1x8 Female Dupont connector for control o Surface Mounted 10k Resistor · Bluetooth: HC05 x 1 o Mounted 1x2 Female Dupont connector for Transmitter and Receiver 6. Other Module · Solderless Breadboard: 81x62mm, 456 tie points The kit shall be used to perform the following experiments and applications: · Buzzer application: Mono tone output / Multi tone output / Song playing · LED matrix display: Static and dynamic · 4-digit 7-segment display: Basic output / Digital clock · Relay control · High power LED application: PWM control with slide potentiometer and PC · Microphone application: Noise detection · CDS application: Light detector · Classical RGB LED control: Static / Dynamic display · Serial RGB LED control: Color control · Parallel LCD display control: Static display · Serial LCD display control: Display temperature · Ultrasonic application: Distance measurement · Infrared application: Line tracer · Servo motor application: Control with slide potentiometer and joystick · Accelerometer application: Balance detection · DC motor application: Speed and direction control			

	· Step motor application: Unipolar and Bipolar control · Bluetooth application: Connect to mobile phone · Wi-Fi application: Connect to cloud The set shall have the following accessories: 1. English Experiment manual x1 2. Software / Source Code CD x 1 3. AC Power Cord x 1 4. USB cable (Type-A to Type-B) x 1 5. Flat cable (5x2 pin) x 1 Dupont wire x 40			
3	**MICROCONTROLLER TRAINER** The Training System shall have the following features: · Uses 8-bit microcontroller, to implement various I/O control experiments. · Contains most of the powerful functions in modern MCUs nowadays · Can be used for automation, motor control, device measurement, and mechanical controls...etc. · Its popular and well-known by its economic cost, · Wide applicability, · High accessibility and reliable stability. · Contains several peripheral devices, from basic LED to advanced capacitive sensing module · Combination of these devices enable to create different kind of control experiments. · Together with friendly experiment manual · Can learn the control of MCU more conveniently and efficiently. · Ideal for beginners of learning programming language. · Each experimental block uses individual control switch to avoid interference if sharing pin. · Pins of the microcontroller have been connected to the peripherals inside the trainer. There is no need to connect it manually. · "Reset" button: to reset the chip if errors occur. · Development interface is reserved for advanced learners, which can connect the external modules to the chip pins. This training equipment shall compose of the following Specifications: 1. PIC16F887 chip x 1 (1) 40 pins(35 input/output pins)	**1**	**Unit**	**60 Calendar Days**

	(2) 368 bytes RAM memory (3) NanoWatt Technology (4) (4) 10-Bit Analog-to-Digital (A/D) Converter (5) Operating Frequency (0~20MHz) 2. UART to USB Interface x 1 3. EEPROM 64Kbits x 1 4. 20 x 2 character LCD x 1 5. 4-digit 7-segment display x 1 6. Capacitive sensing button x 1 7. LED x 11 8. 8 x 8 multicolor dot matrix LED display x 1 9. Buzzer and status LED x 1 10. 5K variable resistor x 1 11. AD590 temperature sensor x 1 12. Stepping motor and status LED 7.5 degrees x 1 13. 10 x 2 extend socket x 2 14. Slide switch x 8 15. 4 x 4 matrix keypad x 1 16. Built-in power supply : Input : 100~240VAC, 50/60Hz, 0.65A Output : 12V/1.2A, 5V/2.1A, 3.3V/1A Experiments for: 1. Basic I/O Controls 2. External Interrupt I/O Experiment 3. Chip Clock 4. Watch dog Timer 5. Timer 6. UART 7. I2C 8. LCD module experiment 9. Temperature Measurement experiment 10. LED matrix display experiment 11. Stepping Motor experiment 12. Capacitive touch sensing experiment This Training Equipment must supply with this following Accessories: 1. A.C. power cord 1pc 2. Fuse 1pc 3. Experiment manual written in English1pc 4. Experiment CD (working codes of the performable experiments) 1pc 5. USB A-B type cable, 150cm 1pc 6. IDC cable 10x2 pin, 20cm 1pc 7. Dupont Line 1P-1P, 150mm 20pc 8. 6pin Programmer Cable 1pc 9. Microchip PICkit 3 debugger/programmer			
4	**Advanced Process Welding Machine** Features: •Process: SMAW, GMAW, FCAW, GTAW	1	Unit	**60 Calendar Days**

	• MIG/MAG inverter welding machine, pulse, with integrated wire feeder and control •Rapid Current Control technology MIG/MAG weld seams, even with long welding leads •Many accessory parts and options can be fixed to the welding machine using customary slot nuts •LED information bar: indicates the current operating status •Welding machine, including wheel kit with single cylinder bracket, water cooling and 5 m mains connection lead •With Synergic characteristics for GMAW standard or pulsed welding for steel/CrNi/aluminium •Suitable for MMA welding, TIG welding and gouging •16 individually configurable programmes for each welding task •Infinitely adjustable arc dynamics •Adjustable start and end-crater functions •Energy-saving thanks to high efficiency and standby function •Easy, tool-free change of welding polarity •Earth fault monitoring (PE protection) •IP23 spray water protected •Connection capability for remote control Welding Machine Specifications: Setting range for welding current: 5 A - 350 A Duty cycle 40 °C: 350 A / 80 % 320 A / 100 % Open Circuit Voltage: 82 V Mains Voltage: 220VAC 3 Phase Tolerances: -25 % up to +20 % Mains frequency: 60 Hz Wire Feed Speed: 5 m/min - 25 m/min 19.685 ipm - 984.253 ipm Spool Diameter: D200 / D300 Cooling capacity at 1 l/min.: 1.5 kW Pump pressure: 3.5 bar Protection classification: IP23 Dimensions (L x B x H): 1152 mm x 686 mm x 976 mm MIG/MAG Welding Torch Features: •Rubber inserts in the grip •Flexible ball joint •Torch trigger protection prevents the arc being ignited			

	unintentionally Duty cycle CO2: 330 A / 100 % Duty cycle M21: 290 A / 100 % Wire: Ø 0.8 mm - 1.2 mm Thread, contact tip: M7 Hose package length: 3 m Bend angle torch neck: 45 ° 5 x Contact tip 0.8 mm, 1.0 mm and 1.2 mm 2 x contact tip holder 31.5 mm and 34.5 mm 1 x gas nozzle 11 mm, 13 mm and 16 mm 1 x gas diffuser 1 x torch key 1 x gas nozzle cleaner TIG Welding Torch Features: • Water-cooled TIG welding torch • Single-push button • Ergonomic GRIP handle for a secure hold and ergonomic use Electrode holder: Ø 2.4 mm Gas nozzle: Ø 10 mm, size 6 Tungsten electrode: Ø 2.4 mm Back cap "long" Duty cycle: DC- 400 A / 100 % Duty cycle: AC 280 A / 100 % Electrode: Ø 1.6 mm - 4.8 mm Hose package length: 4 m 2 torch caps (short, long) 3 electrode holders 1 gas diffuser 3 gas nozzles 1 insulator 6 tungsten electrodes SMAW/MMA Electrode Holder with Cable Length: 4 m Plug: 13 mm Accessories: • Welding Table • Welding Booth • Stationary tungsten electrode grinder w/ Collet Chuck 1.6mm, 2.4mm & 3.2mm • Stationary electrode dryer - temperature adjustable up to 400°C • Welding Accessories			
5	**Advance Virtual Welding Trainer** Items included and technical Specs: I. Hardware a. Welding simulator, with latest Augmented Reality technology. b. Augmented Reality welding helmet, that uses cameras for better recognition of the environment.	1	**Unit**	**60 Calendar Days**

	i. The AR welding helmet can be used by instructors and students with glasses. ii. The coupon may be grabbed and handled as in real life for visual inspection. c. Real welding torches for welding in GMAW, FCAW G/S, SMAW and GTAW d. Five educational welding coupons: Overlapped plate, V-Butt plate, T-Angled plate to plate, V-Butt pipe, T-Angled pipe to plate. e. Compact size and weight (10.8 Kg) and easy transportation. II. Education Lifetime Software a. Software for welding in Augmented Reality in carbon steel b. Welding processes included: GMAW (Axial spray, short circuit, globular), FCAW G/S, GTAW and MMA. c. There is no limit to the number of exercises and practices that can be created from the simulator. d. Welding positions included: PA, PB, PC, PD, PF/PG, PE, PH/PJ, HL045/JL045, 1F, 2F, 3F, 4F, 1G, 2G, 3G, 4G, 5G, 5F, 6G, 6F. e. Coupon thickness in educational coupons: 3mm, 6mm, 10mm Only if we include DVS curricula f. Electrode stick / filler rod diameter available: g. GMAW in carbon and stainless steel: 0,8mm 1mm 1,2 mm ii. SMAW in carbon: 2,5 mm 3,25mm 4mm iii. GTAW in carbon: 2mm 2,4 mm h. Sounds recorded out of real welding testing. i. Possibility to modify technical parameters like voltage, amperage, shielding gas and wire speed during the welding practice and see the effects on the weld. j. Capable of configuring multi-pass welding practices in different process, i.e. Two passes welding practice in GMAW + GTAW. k. The students and instructors to create their own welding practices both from the simulator and the computer. The simulator has an open practice module with no restriction and all parameters open.			

5	l. All simulators are connected and synchronized automatically with the instructor's laptop for sharing their practices videos, data on progression and reports. m. After each exercise the student get a personal assessment that is synchronized automatically with the instructor's PC, without the need of using any kind of USB or similar device. n. Possibility to do tele training mode, where the students and instructors are in different rooms, but everything is synchronized. III. Learning Management System with the following features: a. Possibility to create personal profiles for every the students where they have their data on progress, feedback and personalized students. b. Possibility to create personalized curricula for the students, with theory, practice and tests. c. Possibility to monitor the welding training and practice in real time from the instructors' laptop, either in the same room and from other facility. d. Possibility to create customized welding practices where every aspect can be tailored, even the welding technique. e. Personalized reports for every students with their progression and next steps. f. Available for Windows and Mac OS IV. Other a. Remote technical assistance	1	Unit	
6	**WELDING GEAR PACKAGE** Automatic welding helmet •Automatic welding helme •Operating unit outside helme •Comfortable headband •Infinitely variable sensitivity control Welding Backpack •Practical rucksack for mobile use with a large number of compartments •Upholstered back section permits comfortable carrying even on the roughest construction sites •Backpack for Powershield helmets MIG/MAG Welder's Glove •Cowhide full leather and cow split leather palms, rest in cow split leather	4	Sets	**60 Calendar Days**

	•Suitable for contact heat up to 250 ° •Comfortable padding and heat insulation •Oil and weatherproof Full-view Goggles with Side Protection and Polycarbonate Lenses •Protect against fluid spatter, dust and molten metal with anti-fog coating. •Direct ventilation •Can be worn over corrective spectacles Soft Plastic Welding Safety Glasses •Flip-up •Ideal for spectacle wearers •Colourless, shatterproof lenses and welding safety glass Welding Jacket Leg and foot protection with Velcro fastener Welding apron			
7	**FUME EXTRACTOR** Mobile filter unit for low to medium quantities of fumes/dust Powerful filter and sturdy construction Filter monitoring increases safety Convenient filter replacement via access door For use at two workstations Engine Output: 1.1 kW Extraction capacity 2 x 750 m^3/h Noise level 72 dB(A) TERMS AND CONDITIONS: Warranty: One year on parts and service. (Bidder may opt to offer additional warranty service) Delivery: 120 Calendar Days •Equipment shall be supplied with training manuals in English •Supplier must submit brochures/catalogue indicating the brand name and model of bid item/s additional technical requirements. Failure to submit will be grounds for disqualification. • Bidder must provide After Sales Training onsite or online if travelling is still prohibited during the COVID-19 pandemic • Bidder must attach pictures of their training center and also pictures of after sales training of faculty conducted at their training center as additional technical document requirements	1	Unit	**60 Calendar Days**

	•If bidder is an authorized distributor/reseller of the bid item/s, bidder must attach supporting documents from the manufacturer to support such claim. •Bidder must be authorized from the manufacturer to provide technical training and support and must attach supporting documents.			

7