



Shri Vishwakarma Skill University

(Established Under Government of Haryana Act No.25 of 2016)

Tender Document for Supply of Lab Equipment (Workbenches for Electrical and Electronics Lab)

Tender Enquiry No . SVSU/2018/DA/001

Dated: 05.01.2019

Shri Vishwakarma Skill University
Plot 147, Sector 44, Gurugram, Haryana
www.hvsu.ac.in

Notice Inviting Quotation

Sub: Notice Inviting Tenders for Supply of Workbenches for Electrical and Electronics Lab

Shri Vishwakarma Skill University, invites sealed Tenders from reputed Manufacturers/ Authorized Dealers /Tenderer for procurement of Electrical and Electronic Workbench.

All interested vendors are requested to send their sealed quotation for supply of the above item as per details technical specification given on Page no. 4-19 and as per the Bid Submission details mentioned in Annexure - XI.

The Important information related to tender are as follows:

1. SCHEDULE

1.	EMD Amount	Rs. 50000/- (Rupees Fifty-Five Thousand only)
		Payable as DD to :
		Beneficiary Name: Shri Vishwakarma Skill University,
2.	Performance Security	10% of FOB
3.	Warranty	3 Years
4.	Issue of Tender Document	05.01.2019
5.	Last date for receipt of queries	12.01.2019
6.	Date of pre bid meeting	16.01.2019 at 11.00 AM
7.	Last Date and Time for receipts of Bids	Up to 17:00 Hrs. on 28.01.2019
9.	Place of Bid Submission	Office of Registrar Shri Vishwakarma Skill University, Plot 147, Sector 44 Gurugram , Haryana
11.	Address of Communication	The Registrar Shri Vishwakarma Skill University, Plot 147 , Sector 44 Gurugram Haryana
12.	Contact Phone Numbers	0124 2746800
13.	E-mail Address	registrar.hvsu@gmail.com

*Tender document can also be downloaded (from 05.01.2019) from University Website www.hvsu.ac.in

2. Instructions to Tenderers

Subject: Invitation for Supply of Electronics and electrical Lab Equipment

Shri Vishwakarma Skill University, invites offline Bids (Technical bid and Commercial bid) from eligible and experienced OEM (Original Equipment Manufacturer) OR OEM Authorized Dealer for **Supply of Electronics and Electrical Workbenches** with warranty period as stated at “Schedule” on site comprehensive warranty from the date of receipt of the material as per terms & conditions specified in the tender document.

Tenderers can access tender documents on the website of the University and fill them with all relevant information and submit the completed tender document offline as per the schedule to:

The Registrar

Shri Vishwakarma Skill University,

Plot No 147 Sector 44, Gurugram, Haryana

Technical and Financial bids to be submitted in two sealed envelopes and these envelopes should be placed in one envelope on which “Tenders for Supply & Installation of Electrical and Electronic Workbenches to be mentioned”

3. TECHNICAL SPECIFICATION: -

Serial No	Details of Instrument	Specifications Required in Tender Document
1.	Specifications of Electrical Work Station-I	An Electrical workstation with interactive sources and integrated software with data acquisition system consisting of instrument panel and working table should be suitable for student to learn and perform various experiments of electronics and Electrical related subject. Measuring instruments should internally electrically connect and should be fitted in the panel such that only front panel and necessary interface area easily accessible to use. Top Structure of Electrical workstation with interactive sources and Integrated software with data acquisition system be made of 1.5mm thick CRC powder quoted pipes with top made up of good quality 19mm thick plywood and converted with 1.8mm off white colour mica. The Electrical workstation with interactive sources and Integrated software with data acquisition system working area should be covered by 2mm thick antistatic mat which held student to controls static discharge as static interface or damage to student, equipment and circuitry. 2 he structure of Electrical workstation with interactive sources and integrated software with ate acquisition system should be as follows a) The basic structure should be made of 38x38x1.5 mm CRC powder quoted pipe for sturdiness. b) The overall dimensions of Electrical workstation with interactive sources and Integrated software with data acquisition system should not be made less than W=1200mm d=700mm h=1650mm c) MS draws 03 number 415x290x133mm (HXWXD) and thickness 1.2mm with handle & separate lock on each draws should be provided. d) For the panel station raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS panel strip below it for housing electrical socket and a switch for electrical use. e) Two pole MCB (32 Amp) to be provided for safety of unit. f).The Electrical workstation with interactive sources and integrated software with data acquisition system should work on main supply of 230V AC50 Hz & G) The Electrical workstation with interactive source and integrated software with data acquisition system consist of following accessories; h) Basic Electrical Simulation software single user with hardware lock should be provided which should assist students for topics like basic electricity, Magnetism & Electromagnetism, AC Circuits, Measuring Instruments and DC Machine, AC Machine. Specifications Electrical Measuring Instruments AC Ammeter (4 Nos.) Type : Digital Range : 10A AC Voltmeter (4 Nos.) Type : Digital Range : 450Vrms DC Ammeter (4 Nos.) Type : Digital Range : 30A DC Voltmeter (4 Nos.) Type : Digital Range : 300V Single Phase Wattmeter (2 Nos.) Type : Digital Range : 4kW DC Supply (for excitation purpose only) Voltage : 300V $\pm$ 10% Current : 2Amp Protective Devices Three Phase MCB (TPN) : 2 Nos. Interconnections : 4mm BS-10 Safety Terminals Single Phase Capacitor Start Induction Motor • Study of Operational Working and Principle of Single Phase Induction Motor • Study of Running and Reversing of Single Phase Induction Motor • Study of the No-Load Test in a Single Phase Induction Motor • Study of the Blocked Rotor Test in a Single Phase Induction Motor • Study of Load Test in a Single Phase Induction Motor Three-phase Squirrel Cage Induction Motor • Study of Operational Working and Principle of Three Phase Squirrel Cage Induction Motor • Study of Running and Reversing of Three Phase Induction Motor • Study of No Load Test performed in a Three Phase Induction Motor • Study of Block Rotor Test performed in a Three Phase Induction Motor • Study of Speed-Torque characteristics in a Three Phase Induction Motor Three Phase Salient Pole Synchronous Motor • Study of Operational Working and Principle of Three Phase Synchronous Motor

	• Study of V curve of Three Phase Synchronous Motor • Study of Inverse V curve of the Three Phase Synchronous Motor Single Phase Transformer • Study of Open Circuit test of Single-Phase Transformer • Study of Short Circuit Test of Single-Phase Transformer Machine Specification <u>Type : Three Phase Squirrel Cage Induction Motor</u> Power Rating : 1HP Voltage Rating : 415V AC $\pm$ 5%, 50Hz Rated Speed : 1440RPM $\pm$ 7.5% Insulation : Class 'B' Loading arrangement : Mechanical Spring Balance : 2 Nos. (Tubular Type) Brake Drum/Pulley : Aluminium casted with heat suppression Facility Machine Base : "C" Channel Protection : Fuses (mounted at the terminal box of the Machines) <u>Type : Single phase Capacitor Start Induction Motor</u> Power Rating : 1HP Voltage Rating : 220V AC $\pm$ 5%, 50Hz Rated Speed : 1440RPM $\pm$ 7.5% Insulation : Class 'B' Loading arrangement : Mechanical Spring Balance : 2 Nos. (Tubular Type) Brake Drum/Pulley : Aluminium casted with heat suppression facility Machine Base : "C" Channel Protection : Fuses (mounted at the terminal box of the Machines) <u>Single Phase Transformer</u> Mains Supply : Single Phase, 230V AC $\pm$10%, 50Hz Rating : 1kVA Primary Voltage : 0-125V, 0-125V Secondary Voltage : 0-125V, 0-125V Rated Current : 5A <u>Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base Three Phase Synchronous Machine</u> Type : Salient Type Power Rating : 3 HP Voltage Rating : 415V AC $\pm$ 10%, 50Hz Configuration : "Delta" Connected Rated Speed : 1500RPM $\pm$ 5% Insulation : Class 'B' Type : Shunt Power Rating : 2HP Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' Loading Arrangement : Electrical Type of Coupling : Flexible "Lovejoy" Coupling Machine Base : "C" Channel Protection : Fuses (mounted at the terminal box of the Machines) Single and Three Phase Resistive Load Single Phase Operation Voltage : 240V AC $\pm$10%, 50Hz Current : 15A Power : 3.5kW Loading steps : 15 Three Phase Star Operation Voltage : 415V AC $\pm$10%, 50Hz Current : 5A (per Phase) Power : 3.5kW Loading steps : 5 (per Phase) Three Phase Delta Operation Voltage : 415V AC $\pm$10%, 50Hz Current : 15A (per Phase) Power : 10.5kW Loading steps : 5 (per Phase) Switching Technique : Star/Delta Switch, 415V, 25A Mains MCB : 16A (TPN)
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		Single Phase Variac Type : Close Type Operating Rating : 230V AC $\pm 10\%$, 50Hz Output Voltage : 0 - 270V AC $\pm 10\%$, 50Hz Current : 10A Three Phase Variac Type : Close Type Operating Rating : 415V AC $\pm 10\%$, 50Hz Output Voltage : 0 - 470V AC $\pm 10\%$, 50Hz Current : 10A 2.8A, 220 Ohm Rheostats
2.	<u>Specifications of Electrical Work Station-II</u>	An Electrical workstation with interactive sources and integrated software with data acquisition system consisting of instrument panel and working table should be suitable for student to learn and perform various experiments of electronics and Electrical related subject. Measuring instruments should internally electrically connect and should be fitted in the panel such that only front panel and necessary interface area easily accessible to use. Top Structure of Electrical workstation with interactive sources and Integrated software with data acquisition system be made of 1.5mm thick CRC powder quoted pipes with top made up of good quality 19mm thick plywood and converted with 1.8mm off white colour mica. The Electrical workstation with interactive sources and Integrated software with data acquisition system working area should be covered by 2mm thick antistatic mat which held student to controls static discharge as static interface or damage to student, equipment and circuitry. The structure of Electrical workstation with interactive sources and integrated software with data acquisition system should be as follows a) The basic structure should be made of 38x38x1.5 mm CRC powder quoted pipe for sturdiness. b) The overall dimensions of Electrical workstation with interactive sources and Integrated software with data acquisition system should not be made less than W=1200mm d=700mm h=1650mm c) MS draws 03 number 415x290x133mm (HXWxD) and thickness 1.2mm with handle & separate lock on each draws should be provided. d) For the panel station raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS panel strip below it for housing electrical socket and a switch for electrical use. e) Two pole MCB (32 Amp) to be provided for safety of unit. f) The Electrical workstation with interactive sources and integrated software with data acquisition system should work on main supply of 230V AC 50 Hz & g) The Electrical workstation with interactive source and integrated software with data acquisition system consist of following accessories; h) Basic Electrical Simulation software single user with hardware lock should be provided which should assist students for topics like basic electricity, Magnetism & Electromagnetism, AC Circuits, Measuring Instruments and DC Machine, AC Machine. Technical Specifications Electrical Measuring Instruments AC Ammeter (4 Nos.) Type : Digital Range : 10A AC Voltmeter (4 Nos.) Type : Digital Range : 450Vrms DC Ammeter (4 Nos.) Type : Digital Range : 30A DC Voltmeter (4 Nos.) Type : Digital Range : 300V Single Phase Wattmeter (2 Nos.) Type : Digital Range : 4kW DC Supply (for excitation purpose only) Voltage : 300V $\pm 10\%$ Current : 2Amp Protective Devices Three Phase MCB (TPN) : 2 Nos. Interconnections : 4mm BS-10 Safety Terminals <u>DC Shunt Wound Motor</u> • Study of No Load Characteristic of DC Shunt Motor • Study of Load Characteristic of DC Shunt Motor • Study of speed control of DC Shunt Motor using armature voltage control and flux field control method <u>DC Shunt Wound Generator</u> • Study of Operational Working and Principle of DC Shunt Generator • Study and measurement of Open Circuit Characteristic of DC Shunt Generator • Study and measurement of Load Characteristic of DC Shunt Generator • <u>Hopkinson's test on dc shunt machines</u> <u>DC Series Wound Generator</u> Study and verify the Field Test of DC Series Machine Technical Specifications

		Machine Specification Type : Shunt Power Rating : 1 HP Voltage Rating : 220V DC $\pm$ 5% Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' Loading arrangement : Mechanical Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base DC Machine (acts as prime mover) Type : Shunt Voltage Rating : 220V DC $\pm$ 5% Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' DC Machine (acts as generator) Type : Shunt Power Rating : 0.5HP Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' Shaft extension : Single Sided Loading Arrangement : Electrical Type of Coupling : Flexible "Lovejoy" Coupling Machine Base : "C" Channel Protection : Fuses (mounted at the terminal box of the Machines) Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base DC Machine (acts as prime mover) Type : Series Voltage Rating : 220V DC $\pm$ 5% Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' DC Machine (acts as generator) Type : Series Power Rating : 0.5HP Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' Shaft extension : Single Sided Loading Arrangement : Electrical Type of Coupling : Flexible "Lovejoy" Coupling Machine Base : "C" Channel Protection : Fuses (mounted at the terminal box of the Machines) Both the identical Machines are flexibly coupled and Mounted on a Single 'C' Channel Base Type : Shunt (2Nos) Voltage Rating : 220V DC $\pm$ 5% Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' Loading Arrangement: Electrical Type of Coupling : Flexible "Lovejoy" Coupling Machine Base : "C" Channel Protection : Fuses (mounted at the terminal box of the Machines) Single and Three Phase Resistive Load Single Phase Operation Voltage : 240V AC $\pm$10%, 50Hz Current : 15A Power : 3.5kW Loading steps : 15 Three Phase Star Operation Voltage : 415V AC $\pm$10%, 50Hz Current : 5A (per Phase) Power : 3.5kW Loading steps : 5 (per Phase) Three Phase Delta Operation Voltage : 415V AC $\pm$10%, 50Hz Current : 15A (per Phase) Power : 10.5kW Loading steps : 5 (per Phase) Switching Technique : Star/Delta Switch, 415V, 25A Mains MCB : 16A (TPN) DC Power Supply Input Mains : 230V AC $\pm$10%, 50Hz DC Output Voltage Fixed : 220V $\pm$10%, 2A Variable : 0-220V $\pm$10%, 12A Digital Voltmeter : 300V Digital Ammeter : 20A Single Phase MCB : 16A 2.8A, 220 Ohm Rheostats (2 Nos)
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		0.8A, Rheostats
3.	<u>Specification for Digital Electronics Work Station-I</u>	An integrated Workbench consisting of instrument panel and working table on which students should be able to learn and perform experiments. The instruments should to be fitted in the panel such that only the front panel is accessible & they are internally electrically connected. The Workbench should be made of M.S. powder coated tubular steel pipes with top made up of good quality 19 mm thick plywood with 1.8 mm off white colour laminate covered with antistatic mat protect workbench top from hot soldering iron on the working area. <u>The Technical details of Workbench are as under:</u> 1.The basic structure should be made of 30 x 30 x 1.5 mm tubular mild steel pipes 2. The MS sheet used in pipes should be min. 1.5 mm in thickness for sturdiness 3. The overall dimensions of Workbench should not be less than W = 1200 mm; D = 750 mm; H = 1150 mm 4. 3 nos. - MS drawers with handle & separate lock on each drawer should be provided 5. Fixed levelling screws on the base of the legs should be provided 6. For the panel section, raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS Panel strip below it for housing Electrical Sockets and Switches for external use. 7. 2 Pole MCB (32A) to be provided for safety of Workbench 8. Workbench should work on Mains Supply - 230V AC, 50 Hz <u>Technical specifications of instruments and facility to be installed on the Workbench should be as under:</u> Workbench should have the following key features: 1. 70MHz, Mix Signal Oscilloscope 70MHz 4 analog Channel and 16 digital channel , the oscilloscope should support real time sampling analog channel: 1 GSa/s, Memory Depth should be: 20Mpts, vertical range 1mV/div -10V / div, horizontal range 5ns/div to 50 s/div, the instrument should have triggering facility including edge, pulse, window, slope, RS232/UART, I2C, SPI, it should also have automatic measurements facility and 6 bits hardware counter, 6.5" inch TFT Display, Math functions like A+B, A-B, A×B, A/B, FFT, A&B, A B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs., computer connectivity USB Host & USB Device and LAN. 2. 5 ^{1/2} Digit Digital Multimeter • 5 ^{1/2} digits • Measurement Functions: DC Voltage, AC Voltage, DC Current, AC Current, 2-wire Resistance, 4-wire Resistance, CAP, Diode, Connectivity, Frequency, Period, Any Sensor • Measurement Range: DC Voltage: 200 mV to 1000 V AC Voltage: 200 mV to 750 V DC Current: 200 µA to 10 A AC Current: 20 mA to 10 A Resistance: 200 Ω to 100 MΩ CAP: 2nF to 100 mF Diode: 2V Connectivity: 2000 Ω Frequency: 20 Hz to 1MHz Interface: USB Host, USB Device Temperature controlled Soldering and De soldering station with SMD Iron. 3. <u>Project board for digital electronics.</u> Graphical LCD to show the menu of experiment and gate level diagram for selected experiments • More than 46 Digital electronics experiments on single board • Solder less breadboard • On Board DC Power Supply & Pulse Generator • Software Detailed Learning content with teaching and simulation software Technical Specifications:

		Size of Breadboard : Regular DC Supply : +5 V/1 A +12V/1A Clock Frequency : 1 Hz, 100 Hz, 1 KHz, 100 KHz Amplitude : 3.3 V (TTL) Duty cycle : 50 % Graphical LCD : 128 X 64 dots Pulsar Switches : 2 Nos. Data switches : 8 Nos. (Toggle switches for both TTL modes) LED display : 8 Nos. (TTL) Seven Segment Display : 3 Nos. Power Supply : 100V - 240V AC, 50Hz Online Product Tutorial : Should be provided <u>Technical Specifications of plug and play modules for digital electronics experimentation are as under :-</u> Understanding and Experimentation with Digital IC Training product which provides complete flexibility for hands on learning of a wide range of experiments in digital electronics. This product provides vast learning scope for students to design their own experiments and applications. Students can use digital IC's and connect their Input and Output to design and implement in the circuit. Nvis 6550 can be a part of library and can be issued to students to perform the experiments. Mains Supply : 90V - 250V, 50Hz Fixed DC Power Supply : +12V, -12V, +5V, -5V Fixed TTL Generator : 1Hz, 10Hz, 100Hz, 1kHz, 10kHz and 100kHz Pulse Generator : 5V ZIF Socket : 20 Pins (6 Nos.) 40 Pins (1 No.) Input Section : 12 toggle switches Output Section : 12 LED indicator Display : 7 Segment (2 Nos.) Dimension (mm) : W 350 x D 280 x H 55 Logic Gates The trainer should have following features: Exclusive and compact design Straight forward representation of all logic gates Required inbuilt power supply Designed by considering all the safety standards Manual with theoretical and practical details The trainer should have following Technical Specifications: Input : +5V DC Logic levels : +5V : HIGH (Logic 1) 0V : LOW (Logic 0) The trainer should perform following experiments: Study of AND gate and to verify its truth table Study of OR gate and to verify its truth table Study of NOT gate and to verify its truth table Study of NAND gate and to verify its truth table Study of NOR gate and to verify its truth table Study of XOR gate and to verify its truth table Study of XNOR gate and to verify its truth table Experimentation with Universal Gates-Nand and Nor This trainer describes the formation of AND, OR, NOT, NAND, NOR, XOR and XNOR gates using NAND and NOR gates which are called universal gates. The training system is designed in a way that for performing any experiment students have to connect the links by patch cords, thereby enabling students to learn step by step design of each gate using universal gates. Attractive input and output sections are provided on trainer in a manner that multiple experiments can be performed simultaneously. Designing of NOT gate using NAND gate Designing of AND gate using NAND gate Designing of OR gate using NAND gate Designing of NOT gate using NOR gate Designing of AND gate using NOR gate Designing of OR gate using NOR gate • Exclusive and compact design Straight forward representation of Universal Gates +5V SMPS adaptor provided with the trainer for power supply Designed by considering all the safety standards Online product tutorial Low cost trainer including illustration of logic gates design using universal gates Technical Specifications Input : +5V DC Logic levels +5V : HIGH (Logic 1) 0V : LOW (Logic 0)
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		Dimensions (mm) : D 345 × W 240 × H 110 Weight : 1kg (approximate) <u>De-Morgan's Theorem</u> The trainer should have following features: Easy explanation of both the De-Morgan's theorem statements Designed by considering all the safety standards Different test points Manual with theoretical and practical details The trainer should have following Technical Specifications : Input : +5V DC Logic levels : +5V : HIGH(Logic 1) 0V : LOW (Logic 0) The trainer should performed following experiments: Verifying $(A+B)' = A' \cdot B'$ Verifying $(A \cdot B)' = A' + B'$ <u>Adders and Subtractors</u> The trainer should have following features : A complete system to study the diode characteristics Adaptable illustration of Binary Adders and Subtracters Designed by considering all the safety standards Manual with theoretical and practical details The trainer should have following Technical Specifications : Input : +5 V DC Logic levels : +5 V : HIGH(Logic 1) 0 V : LOW (Logic 0) The trainer should perform following experiments: Study of Binary Half Adder Study of Binary Full Adder using two Half Adders Study of Binary Half Subtractor <u>Flip-Flop</u> The trainer should have following features: Inbuilt DC power Supply Adaptable illustration of Flip-Flops Compact Design Designed by considering all the safety standard Manual with theoretical and practical details The trainer should have following Technical Specifications: Input : +5V DC Logic levels : +5V : HIGH(Logic 1) 0V : LOW (Logic 0) The trainer should performed following experiments : Study of S-R Flip-Flop and to verify its Transition table Study of J-K Flip-Flop and to verify its Transition table Study of D Flip-Flop and to verify its Transition table Study of T Flip-Flop and to verify its Transition table <u>Parallel Adder and Subtractor Demonstrator</u> DC Power Supply +5V DC Logic levels +5V : High (logic 1) 0V : Low (logic 0) LED indication : LED will be ON for logic high or '1' state and will be OFF for Logic low or '0' state Dimensions (mm) : 345 W x 240 D x 110 H 4-bit/8-bit Binary Addition and Subtraction Easy switching between addition and subtraction modes LEDs for visual indication of input-output and carry out logics Online product tutorial Basic digital electronics Simulation software single user with hardware lock should be provided which should assist students for topics like de morgana's law, basic gates/and /or/not, derived gate nand/nor/Xor, derived X or gate, Binary addition and subtraction (half and full) multiplexer and demultiplexer, decimal to bcd encoder, decimal to excess three encoder, decimal to gray encoder, BCD to DECIMAL DECODER, SEVEN SEGMENT DECODER, up counter, down counter, serial in parallel out shift resistor,
	<u>4 . Specification for Digital Electronics Work Station-II</u>	An integrated Workbench consisting of instrument panel and working table on which students should be able to learn and perform experiments. The instruments should to be fitted in the panel such that only the front panel is accessible & they are internally electrically connected. The Workbench should be made of M.S. powder coated tubular steel pipes with top made up of good quality 19 mm thick plywood with 1.8 mm off white colour laminate covered with antistatic mat protect workbench top from hot soldering iron on the working area.

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Seven Segment Display	:	3 Nos.																																	
Power Supply	:	100V - 240V AC, 50Hz																																	

		Online Product Tutorial : Should be provided <u>Technical Specifications of plug and play modules for digital electronics experimentation are as under:-</u> <u>Multiplexer and Demultiplexer</u> The trainer should have following features : A complete system to study the Multiplexer & Demultiplexer Easy illustration of Multiplexer and Demultiplexer LEDs for visual indication of inputs and outputs status SPDT switches for logic selection Manual with theoretical and practical details The trainer should have following Technical Specifications: Input : +5V DC Logic levels : +5V : HIGH (Logic 1) 0V : LOW (Logic 0) LED Indication : LED will ON (glow) for 1 state and will be OFF for 0 state. The trainer should performed following experiments: Study and verification of the Truth Table of 4-to-1 Line Multiplexer Study and verification of the Truth Table of 1-to-4 Line De Multiplexer <u>Encoder and Decoder</u> The trainer should have following features: A complete system to study the Encoder & Decoder Easy illustration of Encoder and Decoder LEDs for visual indication of inputs and outputs status SPDT switches for logic selection Different test points Manual with theoretical and practical details The trainer should have following Technical Specifications: Input : +5V DC Logic levels : +5V : HIGH (Logic 1) 0V : LOW (Logic 0) LED Indication : LED will be ON (glow) for 1 state and will be OFF for state The trainer should performed following experiments: Study and verification of the Truth Table of 8-to-3 Line Encoder. Study and verification of the Truth Table of 3-to-8 Line Decoder. <u>Counters Trainer</u> DC Power Supply : +5V DC Logic levels +5V : High (Logic 1) 0V : Low (Logic 0) LED Indication: LED will be ON for logic high or '1' state and will be OFF for logic low or '0' state Dimensions (mm) : W 260 x D 355 x H125 4 bit synchronous binary up Counter 4 bit asynchronous binary up/down Counter Verification of operation of IC 74LS190 as a modulo-N programmable Counter <u>Shift Registers Trainer</u> DC Power Supply : +5V Logic levels +5 V : High (Logic 1) 0 V : Low (Logic 0) LED Indication : LED will be ON for logic high or '1' state and will be OFF for logic low or '0' state Dimensions (mm) : 260 W x 355 D x 125 H Study of 3-bit and 4-bit serial in serial out shift register (using D Flip-Flops) • Study of 3-bit and 4-bit serial in parallel out shift register Study of 3-bit and 4-bit parallel in serial out shift register Study of 3-bit and 4-bit parallel in parallel out shift register (using D Flip-Flops) (using D Flip-Flops) (using D Flip-Flops) Design of Code converters Design of 7 segment display using LED and bread board With Training, Learning, Operating, Instrument Control and Simulation Software having topics Digital number system Boolean Algebra & Logic Circuits Digital Logic Gates Simplification of Boolean Functions Digital Combinational Logic Combinational Arithmetic Circuits Sequential Circuits Digital Logic Families Basic digital electronics Simulation software single user with hardware lock should be provided
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		which should assist students for topics like de morgen's law, basic gates/and /or/not, derived gate nand/nor/Xor, derived X or gate, Binary addition and subtraction (half and full) multiplexer and demultiplexer, decimal to bcd encoder, decimal to excess three encoder, decimal to gray encoder, BCD to DECIMAL DECODER, SEVEN SEGMENT DECODER, up counter, down counter, serial in parallel out shift resistor,
5.	<u>Specification for analog Electronics Work Station-I</u>	An integrated Workbench consisting of instrument panel and working table on which students should be able to learn and perform experiments. The instruments should to be fitted in the panel such that only the front panel is accessible & they are internally electrically connected. The Workbench should be made of M.S. powder coated tubular steel pipes with top made up of good quality 19 mm thick plywood with 1.8 mm off white colour laminate covered with antistatic mat protect workbench top from hot soldering iron on the working area. <u>The Technical details of Workbench are as under:</u> 1.The basic structure should be made of 30 x 30 x 1.5 mm tubular mild steel pipes 2. The MS sheet used in pipes should be min. 1.5 mm in thickness for sturdiness 3. The overall dimensions of Workbench should not be less than W = 1200 mm; D = 750 mm; H = 1150 mm 4. 3 nos. - MS drawers with handle & separate lock on each drawer should be provided 5. Fixed levelling screws on the base of the legs should be provided 6. For the panel section, raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS Panel strip below it for housing Electrical Sockets and Switches for external use. 7. 2 Pole MCB (32A) to be provided for safety of Workbench 8. Workbench should work on Mains Supply - 230V AC, 50 Hz <u>Technical specifications of instruments and facility to be installed on the Workbench should be as under:</u> Workbench should have the following key features: 1) <u>50 Mhz 4 Channel Digital Storage Oscilloscope</u> 50MHz 4 analog Channel Digital Storage Oscilloscope, the oscilloscope should support real time sampling analog channel: 1 GSa/s, Memory Depth should be: 20Mpts, vertical range 1mV/div -10V / div, horizontal range 5ns/div to 50 s/div, the instrument should have triggering facility including edge, pulse, window, slope, RS232/UART, I2C, SPI, it should also have automatic measurements facility and 6 bits hardware counter, 6.5" inch TFT Display, Math functions like A+B, A-B, AxB, A/B, FFT, A&&B, A B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs., computer connectivity USB Host & USB Device and LAN. 2) <u>2 Channel 25 MHz Arbitrary Waveform Generator</u> Sine: 1 µHz - 25 MHz, Square: 1 µHz - 10 MHz, Pulse: 1 µHz - 10 MHz, Ramp: 1 µHz - 500 kHz, Arb: 1 µHz - 10 MHz, Sampling Rate 125MSa/Sec, Memory 2Mpts, other waveform including Noise, Display 4.3 inch TFT LCD with touch screen, Vertical Resolution 16 bits, Built in 7 digit 240MHz frequency counter, Amplitude 1mVpp to 10Vpp, Modulation AM,FM,PM,ASK,FSK,PSK,PWM, Liner/Logarithmic Sweep Mode, Burst Mode, computer connectivity USB Host & USB Device. 3) <u>DC Programmable Power Supply</u> Channels: 3 ,Voltage/Current:CH1: 0 ~ 30V/0 ~ 3A,CH2: 0 ~ 30V/0 ~ 3A,CH3: 0 ~ 5V/0 ~ 3A Over Voltage Protection : Should be available, Over Current Protection : Should be available Load Regulation : Voltage: < 0.02% + 2mV,Current: < 0.02% + 250µA Linear Regulation: Voltage: < 0.02% + 2mV,Current: < 0.02% + 250µA Ripples and Noise(20 Hz to 20 MHz) :Normal Mode Voltage: < 400µVrms/3mVpp Accuracy : a. Voltage CH1: 0.05% + 20mV,CH2: 0.05% + 20mV,CH3: 0.1% + 5mV Current :CH1: 0.2% + 5mA,CH2: 0.2% + 5mA,CH3: 0.2% + 5mA Resolution :Voltage: 10mV, Current: 1mA Independent control for each channel

Display: 3 inch TFT
Interface: USB Host, USB Device

4) 5 1/2 Digit Digital Multimeter

- 5 1/2 digits
- Measurement Functions: DC Voltage, AC Voltage, DC Current, AC Current, 2-wire Resistance, 4-wire Resistance, CAP, Diode, Connectivity, Frequency, Period, Any Sensor
- Measurement Range:
DC Voltage: 200 mV to 1000 V
AC Voltage: 200 mV to 750 V
DC Current: 200 μ A to 10 A
AC Current: 20 mA to 10 A
Resistance: 200 Ω to 100 M Ω
CAP : 2nF to 100 mF
Diode : 2V
Connectivity: 2000 Ω
Frequency : 20 Hz to 1MHz
Interface : USB Host, USB Device

Technical Specifications of plug and play modules for Analog electronics experimentation are as under:-

Diode Characteristics

The trainer should have following features :
A complete system to study the diode characteristics
Forward and reverse characteristics experiment
Silicon, Zener and Germanium diode
Ammeter and Voltmeter for measurement
Different test points
Manual with theoretical and practical details

The trainer should have following Technical Specifications :

On Board DC power supply	:	+12V DC
Ammeter		
Range	:	1 μ A to 200mA
Display	:	3 1/2 digit
Voltmeter		
Range	:	1mV to 200V
Display	:	3 1/2 digit
Mains power	:	230V AC $\pm$ 10%

The trainer should performed following experiments :
Study of V-I characteristics of Silicon Diode
Study of V-I characteristics of Zener Diode
Study of V-I characteristics of Light Emitting Diode (LED)

Transistor Characteristics

The trainer should have following features :
A complete system to study the Transistor characteristics
On board DC power supplies
In-built Ammeter and Voltmeter
Different test points
Three important characteristics of a Transistor
Input characteristic
Output characteristic
Constant current transfer characteristic
Manual with theoretical and practical details

The trainer should have following Technical Specifications :

DC power supply	:	+5 V, -5 V, +12 V, -12 V
Transistor	:	BC548, 2N3906
Ammeter		
Range	:	1 μ A to 200 mA
Display	:	3 1/2 digit
Voltmeter		
Range	:	1mV to 200 V
Display : 3 1/2 digit		
Mains	:	230 V AC $\pm$ 10%

The trainer should performed following experiments:
Study of the characteristics of PNP transistor in Common Base Configuration and to evaluate - Input

		resistance, Output resistance and Current gain. Study of the characteristics of PNP transistor in Common Collector Configuration and to evaluate - Input resistance, Output resistance and Current gain. Study the characteristics of NPN transistor in common Emitter Configuration and to evaluate - Input resistance, Output resistance and Current gain. Study of the characteristics of NPN transistor in Common Base configuration and to evaluate - Input resistance, Output resistance and Current gain. Study of the characteristics of NPN transistor in Common Collector configuration and to evaluate - Input resistance, Output resistance and Current gain. Study the characteristics of PNP transistor in Common Emitter Configuration and to evaluate - Input resistance, Output resistance and Current gain. Rectifier training system The trainer should have following features : A complete system to study the Rectifier Real time appearance of components Test points in different sections of power supply Designed by considering all the safety standards Manual with theoretical and practical details The trainer should have following Technical Specifications : <table> <tr> <td>Transformer Rating</td><td>:</td><td>9 V centre tapped (300 mA) approx.</td></tr> <tr> <td>Mains Supply</td><td>:</td><td>230 V, $\pm 10\%$, 50 Hz</td></tr> <tr> <td>Half wave Rectifier output</td><td>:</td><td>+ 4 V DC approx.</td></tr> <tr> <td>Centre-Trapped Rectifier</td><td>:</td><td>+8 V DC approx.</td></tr> <tr> <td>Bridge Rectifier Output</td><td>:</td><td>+ 8 V DC approx.</td></tr> <tr> <td>Filter</td><td>:</td><td>LC Type</td></tr> <tr> <td>Load</td><td>:</td><td>Resistive 220 W</td></tr> </table> The trainer should performed following experiments: Study of Half-wave Rectifier Study of Full-wave Centre-tapped Rectifier Study of Full-wave Bridge Rectifier Calculation of Ripple Factor and Efficiency of various Rectifier Wein bridge Oscillator training system The trainer should have following features : Exclusive and compact design. Straight forward representation of Wein Bridge Oscillator. inbuilt power supply. Designed with considering all the safety standards. Manual with theoretical and practical details The trainer should have following Technical Specifications : <table> <tr> <td>Biasing Voltage</td><td>:</td><td>+12V,-12V</td></tr> <tr> <td>Design of Oscillator</td><td>:</td><td>Passive Element with OP-</td></tr> </table> The trainer should performed following experiments : Study of design and functioning of Wein Bridge Oscillator Zener Diode Voltage Regulator training system The trainer should have following features : A complete system to study the diode characteristics Different test points Manual with theoretical and practical details The trainer should have following Technical Specifications : <table> <tr> <td>mains Supply</td><td>:</td><td>230 V $\pm 10\%$, 50 Hz</td></tr> <tr> <td>Transformer</td><td>:</td><td>0 - 9 V, 500 mA (approx.)</td></tr> <tr> <td>Filter</td><td>:</td><td>Capacitive</td></tr> <tr> <td>1000 μF, 35 V</td><td>:</td><td></td></tr> <tr> <td>Zener Diode</td><td>:</td><td>V_z = 5.6 V</td></tr> <tr> <td>I_{ZM} = 178 mA</td><td>:</td><td></td></tr> <tr> <td>Potentiometer, P1</td><td>:</td><td>4.7 KW</td></tr> <tr> <td>Potentiometer, P2</td><td>:</td><td>4.7 KW</td></tr> </table> The trainer should performed following experiments : Study of Zener Diode as a Voltage Regulator, when input voltage, V_{in} is fixed while load resistance R_L is variable. Study of Zener Diode as a Voltage Regulator, when input voltage, V_{in} is variable while load resistance R_L is fixed	Transformer Rating	:	9 V centre tapped (300 mA) approx.	Mains Supply	:	230 V, $\pm 10\%$, 50 Hz	Half wave Rectifier output	:	+ 4 V DC approx.	Centre-Trapped Rectifier	:	+8 V DC approx.	Bridge Rectifier Output	:	+ 8 V DC approx.	Filter	:	LC Type	Load	:	Resistive 220 W	Biasing Voltage	:	+12V,-12V	Design of Oscillator	:	Passive Element with OP-	mains Supply	:	230 V $\pm 10\%$, 50 Hz	Transformer	:	0 - 9 V, 500 mA (approx.)	Filter	:	Capacitive	1000 μ F, 35 V	:		Zener Diode	:	V _z = 5.6 V	I _{ZM} = 178 mA	:		Potentiometer, P1	:	4.7 KW	Potentiometer, P2	:	4.7 KW
Transformer Rating	:	9 V centre tapped (300 mA) approx.																																																			
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		Experimentation with BJT Amplifiers and Emitter Follower training system To study the operation of single stage and multi stage RC–Coupled amplifier To plot the frequency response of RC–Coupled amplifier To calculate the current gain and input impedance of Darlington pair and β of a transistor to calculate the voltage gain of Darlington pair using voltage divider biasing DC power supply : +12V, +5V Fuse : 500mA, slow blow Sine wave generator Frequency : 10Hz - 100kHz $\pm 10\%$ Amplitude : 0 to 5Vpp Mains supply : 230V $\pm 10\%$, 50Hz Dimensions (mm) : W 240 x D 345 x H 110 Basic analog electronics Simulation software single user with hardware lock should be provided which should assist students for topics like Basic Electrical Concepts Basic Circuits Fundamentals of Resistor/Capacitor/Inductor Transformers Semiconductors & Diodes Transistor & basic transistor circuits Operational Amplifiers (Op Amps): Characteristics & Specifications Practical Op-Amp circuits Power Supplies & Rectifiers
6.	<u>Specification for analog Electronics Work Station-II</u>	An integrated Workbench consisting of instrument panel and working table on which students should be able to learn and perform experiments. The instruments should to be fitted in the panel such that only the front panel is accessible & they are internally electrically connected. The Workbench should be made of M.S. powder coated tubular steel pipes with top made up of good quality 19 mm thick plywood with 1.8 mm off white colour laminate covered with antistatic mat protect workbench top from hot soldering iron on the working area. <u>The Technical details of Workbench are as under:</u> 1.The basic structure should be made of 30 x 30 x 1.5 mm tubular mild steel pipes 2. The MS sheet used in pipes should be min. 1.5 mm in thickness for sturdiness 3. The overall dimensions of Workbench should not be less than W = 1200 mm; D = 750 mm; H = 1150 mm 4. 3 nos. - MS drawers with handle & separate lock on each drawer should be provided 5. Fixed levelling screws on the base of the legs should be provided 6. For the panel section, raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS Panel strip below it for housing Electrical Sockets and Switches for external use. 7. 2 Pole MCB (32A) to be provided for safety of Workbench 8. Workbench should work on Mains Supply - 230V AC, 50 Hz <u>Technical specifications of instruments and facility to be installed on the Workbench should be as under:</u> Workbench should have the following key features: 1) <u>50 Mhz 4 Channel Digital Storage Oscilloscope</u> 50MHz 4 analog Channel Digital Storage Oscilloscope, the oscilloscope should support real time sampling analog channel: 1 GSa/s, Memory Depth should be: 20Mpts, vertical range 1mV/div -10V / div, horizontal range 5ns/div to 50 s/div, the instrument should have triggering facility including edge, pulse, window, slope, RS232/UART, I2C, SPI, it should also have automatic measurements facility and 6 bits hardware counter, 6.5" inch TFT Display, Math functions like A+B, A-B, AxB, A/B, FFT, A&&B, A B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs., computer connectivity USB Host & USB Device and LAN. 2) <u>2 Channel 25 MHz Arbitrary Waveform Generator</u> Sine: 1 μHz - 25 MHz, Square: 1 μHz - 10 MHz, Pulse: 1 μHz - 10 MHz, Ramp: 1 μHz - 500 kHz, Arb: 1 μHz - 10 MHz, Sampling Rate 125MSa/Sec, Memory 2Mpts, other waveform including Noise, Display 4.3 inch TFT LCD with touch screen, Vertical Resolution 16 bits, Built in 7 digit 240MHz frequency counter, Amplitude 1mVpp to 10Vpp, Modulation AM,FM,PM,ASK,FSK,PSK,PWM, Liner/Logarithmic Sweep Mode, Burst Mode, computer connectivity USB Host & USB Device. 3) <u>DC Programmable Power Supply</u> Channels: 3 ,Voltage/Current:CH1: 0 ~ 30V/0 ~ 3A,CH2: 0 ~ 30V/0 ~ 3A,CH3: 0 ~ 5V/0 ~

	3A Over Voltage Protection : Should be available, Over Current Protection : Should be available Load Regulation : Voltage: < 0.02% + 2mV,Current: < 0.02% + 250μA Linear Regulation: Voltage: < 0.02% + 2mV,Current: < 0.02% + 250μA Ripples and Noise(20 Hz to 20 MHz) :Normal Mode Voltage: < 400μVrms/3mVpp Accuracy : a. Voltage CH1: 0.05% + 20mV,CH2: 0.05% + 20mV,CH3: 0.1% + 5mV Current :CH1: 0.2% + 5mA,CH2: 0.2% + 5mA,CH3: 0.2% + 5mA Resolution :Voltage: 10mV, Current: 1mA Independent control for each channel Display: 3 inch TFT Interface: USB Host, USB Device 4) 5 ^{1/2} Digit Digital Multimeter • 5 ½ digits • Measurement Functions: DC Voltage, AC Voltage, DC Current, AC Current, 2-wire Resistance, 4-wire Resistance, CAP, Diode, Connectivity, Frequency, Period, Any Sensor • Measurement Range: - DC Voltage: 200 mV to 1000 V - AC Voltage: 200 mV to 750 V - DC Current: 200 μA to 10 A - AC Current: 20 mA to 10 A - Resistance: 200 Ω to 100 MΩ - CAP : 2nF to 100 mF - Diode : 2V - Connectivity: 2000 Ω - Frequency : 20 Hz to 1MHz - Interface : USB Host, USB Device <u>Technical Specifications of plug and play modules for Analog electronics experimentation are as under:-</u> <u>SMPS Trainering setup</u> Trainer should have following features - LCD Display to various relevant experiment parameters. - Facility to measure signals on Oscilloscope - Isolated Power supply for Input to avoid Shock Hazard - Diagrammatic representation of circuit for better understanding - Test Points should provided to observe signals at various stages - Fault identification switches for fault analysis - Protective shield to prevent shock - Should designed considering all safety standards The training setup should have following specifications <table> <tr> <td>Input</td> <td>85 to 230V AC, 50Hz</td> </tr> <tr> <td>Output</td> <td>+12V DC regulated</td> </tr> <tr> <td></td> <td>-12V DC regulated</td> </tr> <tr> <td></td> <td>+5V DC regulated</td> </tr> </table> Switching Transformer <table> <tr> <td>Input</td> <td>320V DC switching at 120KHz or above</td> </tr> <tr> <td>Output</td> <td>30V AC</td> </tr> </table> Experiment can be performed - Study of Primary rectifier and Filter section - Study of Switching Transformer - Study of Optocoupler - Study of Regulation - Study of SMPS with Variac input (Variable AC)-Regulation Test - Study of various faults and procedure of their trouble shooting Clipper and Clamper training system The trainer should have following features : - A complete system to study the Clipper & Clamper - Different test points - Manual with theoretical and practical details The trainer should have following Technical Specifications : <table> <tr> <td>Mains Supply</td> <td>: 230 V ±10%, 50 Hz</td> </tr> </table>	Input	85 to 230V AC, 50Hz	Output	+12V DC regulated		-12V DC regulated		+5V DC regulated	Input	320V DC switching at 120KHz or above	Output	30V AC	Mains Supply	: 230 V ±10%, 50 Hz
Input	85 to 230V AC, 50Hz														
Output	+12V DC regulated														
	-12V DC regulated														
	+5V DC regulated														
Input	320V DC switching at 120KHz or above														
Output	30V AC														
Mains Supply	: 230 V ±10%, 50 Hz														

		Sine Wave Generator : 1 KHz, 15V Vpp (approx.) DC Power Supply : 0 - 5 V (vary through rotary switch for specific voltage level) The trainer should performed following experiments : Study of Series Positive Clipper and Series Negative Clipper Circuits Study of Shunt Positive Clipper and Shunt Negative Clipper Circuits Study of Biased Series Positive Clipper and Biased Series Negative Clipper Circuits Study of Biased Shunt Positive Clipper and Biased Shunt Negative Clipper Circuits Study of Combination Clipper Circuit Study of Positive and Negative Clamper Circuits Study of Biased Clamper Circuits Understanding Characteristics of MOSFET, FET and UJT To study and plot the Drain Characteristics of n channel MOSFET To study and plot the Transfer Characteristics of n channel MOSFET To study and plot the V-I characteristics of JFET Evaluation of following parameters of JFET: -DC Drain resistance –Trans conductance -Amplification factor To plot the VI characteristics of UJT Evaluation of following parameters of UJT: -Intrinsic Stand- off Ratio -Inter base resistance Technical Specifications Mains Supply : 90-230V, 50Hz DC Fixed Power Supply : -5V, +15V, +35V DC Variable Power Supply :1.5V to 14 V 1.5V to 34V Voltmeter : 0-200V Ammeter : 0-200mA Bread Board Dimension (mm) : 175 x 61 x 10 Distribution strips : 2 Distribution holes : 200 Terminal Strips : 1 Terminal holes : 640 Resistor Bank : M.F.R. 100E 1W (3 Nos.) M.F.R. 470E 1W (3 Nos.) M.F.R. 1K 1W(3 Nos.) Variable Resistances : 5 K? Ten turn Potentiometer (1 No.) 10 K? Ten turn Potentiometer (1 No.) 5 Kohm Single turn Potentiometer (1 No.) Fuse : 500 mA, slow blow Dimensions (mm) : 350 x D 280 x H 55 Operational Amplifier Lab training system Inverting Amplifier Non - inverting Amplifier Buffer Comparator Adder Subtractor Square Wave Generator Differentiator and its working as High Pass Filter Integrator and its working as Low Pass Filter Logarithmic Amplifier Voltage Controlled Current Source Current Controlled Voltage Source Technical specification Mains Power Supply : 90 - 270V $\pm 10\%$, 50Hz (SMPS) Fixed DC Power Supply : +12V, Regulated -12V, Regulated +5V, Regulated -5V, Regulated Variable DC Power Supply : +1.5V to +10V Regulated : -1.5V to -10V Regulated Function Generator Sine Wave Frequency : 1KHz to 100KHz Frequency Control : 100KV, 10 turn Potentiometer Amplitude : 0V to 5Vpp Amplitude Control : 100KV, Single turn Potentiometer Triangular Wave Frequency : 1KHz to 100KHz Frequency Control : 100KV, 10 turn Potentiometer Amplitude : 0V to 5Vpp Amplitude Control : 100KV, Single turn Potentiometer Square Wave Frequency : 1KHz to 100KHz Frequency Control : 100KV, 10 turn Potentiometer Amplitude : 5Vpp, fixed Bread Board Dimension(mm) : 175 x 61 x 10 Distribution strips : 2 Distribution holes : 200 Terminal holes : 640 Op-Amp : IC uA741 (2 nos.) : All pins terminated on 2 mm Banana Sockets Supply Voltage : $\pm 22V$ max. Differential Input Voltage : $\pm 30V$ max. Input Voltage : $\pm 15V$ max. Slew Rate : 0.5 V/μs ($V_{CC} = \pm 15V$) Resistor Bank SMD Resistance 1KV 1% 1/4W (5 nos.) SMD Resistance 10KV 1% 1/4W (5 nos.) SMD Resistance 100KV 1% 1/4W (5 nos.) Diode : Diode 1N 4007 Capacitor Bank : Electrolyte 1mf/63V Disc 1nf/63V Disc 10nf/63V Disc 100nf/63V Variable Resistance Bank 1KV Single turn Potentiometer (2 nos.) 10KV Single turn Potentiometer (2 nos.) 100KV Single turn Potentiometer (2 nos.) 1MV Single turn Potentiometer (2 nos.) Fuse : 500mA, slow blow Dimensions (mm) : W 350 x D 280 x H 55 Basic analog electronics Simulation software single user with hardware lock should be provided which should assist students for topics like Basic Electrical Concepts Basic Circuits Fundamentals of Resistor/Capacitor/Inductor Transformers Semiconductors & Diodes Transistor & basic transistor circuits Operational Amplifiers (Op Amps): Characteristics & Specifications Practical Op-Amp circuits Power Supplies & Rectifiers Rectifier training system Real time appearance of components Test points are provided in different sections of Power Supply Demonstration bridge Designed by considering all the safety standards Provided with a detailed Operating manual Low cost yet including many experiments Input : 230 V $\pm 10\%$, 50 Hz Outputs Zener diode outputs : 10 V, 5.6 V regulated Regulators outputs : +12 V regulated -12 V regulated 1.8 to 17 V adjustable Load : 5 K variable with 1 K fixed resistance.
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		Bleeder Resistor : 5 K variable with 1 K fixed resistance. Astable Multivibrator : 1 Hz, 14 Vpp Transformer : Primary 0 to 220 V Secondary 18-0-18, 6-0-6 (500 mA) Fuse : 500 mA (slow blow, spare fuse is given in mains socket) Study of Transformers and its working Study of Two diode Full Wave Rectifier Study of Full Wave Bridge Rectifier Study of Demonstration Bridge Study of Ripple Factor and to calculate Ripple Factor of Half Wave, Full Wave and Bridge Rectifier Study of LC and π filter Study of Bleeder Resistor and its effect on load current Study of Zener Diode as Regulator Study of Positive Regulated Supply Study of Negative Regulated Supply Study of Adjustable Regulated Supply Study of Line Regulation Study of Load Regulation Essential accessories:- DC Power Supply : 5V, 200mA AC Power Supply : 6V, 1A Relay : 5V Galvanometer : 30 - 0 - 30 Galvanometer Resistance : 80W Light Bulbs : 6V Potentiometers : 25W, 1W, 10kW, 1W Switch : 1 Pole, 2 Way Toggle type Core Types : E, I, U Training System Includes • Components box with a. Resistors b. Capacitors c. Transistors d. Diode e. Potentiometer E, I, U cores Set of coils Magnetic compass Bar magnets Screw driver Connection patch cords
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Note: All the accessories offered should be of same (instrument) OEM make only.

A complete set of tender documents may be Downloaded by prospective tenderer free of cost from the website. Tenderer has to make payment of requisite fees (i.e. Tender fees and EMD)

4. TERMS & CONDITIONS

- 4.1 **A. Prices:** Prices should be for destination and should be quoted all asked items of Tender Documents.
- B. Due date:** The tender has to be submitted off-line on or before the due date. The offers received after the due date and time will not be considered.
- 4.2 **Preparation of Bids:** The offer/bid should be submitted in two bid systems (i.e.) Technical bid and financial bid. The technical bid should consist of all technical details along with commercial terms and conditions. Financial bid should indicate item wise price for the items mentioned in the technical bid.
- 4.3 **EMD :** The Tenderer should submit an EMD amount in for of Demand Draft drawn in favour of Haryana Vishwakarma Skill University. The Technical Bid without EMD would be considered as UNRESPONSIVE and will not be accepted. The EMD will be refunded without any interest to the unsuccessful Tenderers after the award of contract. Refer to Schedule (at page 2 of this document) for its actual place of submission.
- 4.4 **Refund of EMD:** The EMD will be returned to unsuccessful tenderers only after the Tenders are finalized. In case of successful Tenderer, it will be retained till the successful and complete installation of the equipment.
- 4.5 **Opening of the tender:** The bid will be opened by a committee duly constituted for this purpose in presence of Tenderer's representative if available. Only one representative will be allowed to participate in the tender opening. Bid received without EMD will be rejected. The technical bid will be opened first and it will be examined by a technical committee (as per specification and requirement). The financial offer/bid will be opened only for the offer/bid which are technically qualified as per the specification, and will be opened in the presence of the vendor's representatives subsequently for further evaluation. The tenderer if interested may participate on the tender opening Date and Time. The tenderer should produce authorization letter from their company to participate in the tender opening. The University may call bidders for demonstration of the equipment during technical evaluation. The University will not pay any TA/DA for presentation/ demonstration.
- 4.6 **Acceptance/ Rejection of bids:** The Committee reserves the right to reject any bid not fulfilling the eligibility criteria.
- 4.7 **Eligibility Criteria:**
- (i) Tenderer should be the manufacturer / authorized dealer. Letter of Authorization from original equipment manufacturer (OEM) specific to the tender should be enclosed.
 - (ii) An undertaking from the OEM is required stating that they would facilitate the tenderer on a regular basis with technology/product updates and extend support for the warranty as well. (Ref. Annexure-IV)
 - (iii) OEM should be Nationally/Internationally reputed Company.
 - (iv) Non-compliance of tender terms, non-submission of required documents, lack of clarity of the specifications, contradiction between tenderer specification and supporting documents etc. may lead to rejection of the bid.
 - (v) In the tender, either the Indian agent on behalf of the Principal/OEM or Principal/OEM itself can bid but both cannot bid simultaneously for the same item/product in the same tender.
 - (vi) If an agent submits bid on behalf of the Principal/OEM, the same agent shall not submit a bid on behalf of another Principal/OEM in the same tender for the same item/product.
 - (vii) Sample for offered items may be asked from tender during Technical evaluation.

- 4.8 **Performance Security:** The supplier shall require to submit the performance security in the form of irrevocable bank guarantee issued by any Indian Nationalized Bank for an amount which is stated at the “Schedule” of the tender document within 21 days from the date of receipt of the purchase order and should be kept valid for a period of 60 days beyond the date of completion of warranty period.
- 4.9 **Force Majeure:** The Supplier shall not be liable for forfeiture of its performance security, liquidated damages or termination for default, if and to the extent that, it's delay in performance or other failure to perform its obligations under the Contract is the result of an event of Force Majeure.
(i) For purposes of this Clause, "Force Majeure" means an event beyond the control of the Supplier and not involving the Supplier's fault or negligence and not foreseeable. Such events may include, but are not limited to, acts of the Purchaser either in its sovereign or contractual capacity, wars or revolutions, fires, floods, epidemics, quarantine restrictions and freight embargoes.
(ii) If a Force Majeure situation arises, the Supplier shall promptly notify the Purchaser in writing of such conditions and the cause thereof. Unless otherwise directed by the Purchaser in writing, the Supplier shall continue to perform its obligations under the Contract as far as is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event.
- 4.10 **Risk Purchase Clause:** In event of failure of supply of the item/equipment within the stipulated delivery schedule, the purchaser has all the right to purchase the item/equipment from the other source on the total risk of the supplier under risk purchase clause.
- 4.11 **Packing Instructions:** Each package will be marked on three sides with proper paint/indelible ink, the following:
(i) Item Nomenclature
(ii) Order/Contract No.
(iii) Country of Origin of Goods
(iv) Supplier's Name and Address
(v) Consignee details
(vi) Packing list reference number
- 4.12 **Delivery and Documents:**
Delivery of the goods should be made within a maximum of 04 to 06 weeks from the date of placement of purchase order. Within 24 hours of shipment, the supplier shall notify the purchaser and the insurance company by cable/telex/fax/e mail the full details of the shipment including contract number, railway receipt number/ AAP etc. and date, description of goods, quantity, name of the consignee, invoice etc. The supplier shall mail the following documents to the purchaser with a copy to the insurance company:
(i) 4 Copies of the Supplier invoice showing contract number, goods' description, quantity
(ii) unit price, total amount;
(iii) Insurance Certificate if applicable;
(iv) Manufacturer's/Supplier's warranty certificate;
(v) Inspection Certificate issued by the nominated inspection agency, if any
(vi) Supplier's factory inspection report; and
(vii) Certificate of Origin (if possible by the beneficiary);
(viii) Two copies of the packing list identifying the contents of each package.
(ix) The above documents should be received by the Purchaser before arrival of the Goods (except where the Goods have been delivered directly to the Consignee with all documents) and, if not received, the Supplier will be responsible for any consequent expenses.

4.13 Liquidated Damages (L.D):

If a supplier fails to execute the order in time as per the terms and conditions stipulated therein, it will be open to the purchaser to recover liquidated damages for delay in delivery and installation from the supplier at the rate 0.5% of the value of the stores per week subject to a maximum of 10% of the total order value. The L.D charges can be increased in case of gross violation of the Purchase Order terms as decided by the Vice Chancellor of University. .

4.14 Prices: The price must should be quoted for all items and must include all packing and delivery charges. The offer/bid should be exclusive of taxes and duties, which will be paid by the purchaser as applicable. However, the percentage of taxes & duties shall be clearly indicated.

4.15 Progress of Supply: Wherever applicable, supplier shall regularly intimate progress of supply, in writing, to the Purchaser as under:

- (i) Quantity offered for inspection and date;
- (ii) Quantity accepted/rejected by inspecting agency and date;
- (iii) Quantity dispatched/delivered to consignees and date;
- (iv) Quantity where incidental services have been satisfactorily completed with date;
- (v) Quantity where rectification/repair/replacement effected/completed on receipt of any communication from consignee/Purchaser with date;
- (vi) Date of completion of entire Contract including incidental services, if any; and
- (vii) Date of receipt of entire payments under the Contract (In case of stage-wise inspection, details required may also be specified).

4.16 Resolution of Disputes: The dispute resolution mechanism would be as follows:

(i) In case of Dispute or difference arising between the Purchaser and a domestic supplier relating to any matter arising out of or connected with this agreement, such disputes or difference shall be settled in accordance with the Indian Arbitration & Conciliation Act, 1996, the rules there under and any statutory modifications or re-enactments thereof shall apply to the arbitration proceedings. The dispute shall be referred to the Vice Chancellor, Shri Vishwakarma Skill University and if he is unable or unwilling to act, the sole arbitration of some other person appointed by him willing to act as such Arbitrator. The award of the arbitrator so appointed shall be final, conclusive and binding on all parties to this order.

(ii) In the case of a dispute between the purchaser and a Foreign Supplier, the dispute shall be settled by arbitration in accordance with provision of sub-clause (i) above. But if this is not acceptable to the supplier then the dispute shall be settled in accordance with provisions of UNCITRAL (United Nations Commission on International Trade Law) Arbitration Rules.

(iii) The venue of the arbitration shall be the place from where the order is issued.

4.17 Applicable Law: The place of jurisdiction would be Haryana

4.18 Right to Use Defective Goods

If after delivery, acceptance and installation and within the guarantee and warranty period, the operation or use of the goods proves to be unsatisfactory, the Purchaser shall have the right to continue to operate or use such goods until rectifications of defects, errors or omissions by repair or by partial or complete replacement is made without interfering with the Purchaser's operation.

4.19 Transfer and Subletting: The supplier shall not sublet, transfer, assign or otherwise part with the acceptance to the tender or any part thereof, either directly or indirectly, without the prior written permission of the Purchaser.

4.20 **Supplier Integrity**

The Supplier is responsible for and obliged to conduct all contracted activities in accordance with the Contract using state of the art methods and economic principles and exercising all means available to achieve the performance specified in the contract.

4.21 **Installation & Demonstration**

The supplier is required to do the installation and demonstration of the equipment within one week of the arrival of materials at the SVSU, Gurugram, site of installation, otherwise the penalty clause will be the same as per the supply of materials.

In case of any damage to equipment and supplies during the carriage of supplies from the origin of equipment to the installation site, the supplier has to replace it with new equipment/supplies immediately at his own risk. Supplier will settle his claim with the insurance company as per his convenience. SVSU will not be liable to any type of losses in any form.

4.22 **Insurance:** For delivery of goods at the purchaser's premises, the insurance shall be obtained by the supplier in an amount equal to 110% of the value of the goods from "warehouse to warehouse" (final destinations) on "All Risks" basis including War Risks and Strikes. The insurance shall be valid for a period of not less than 3 months after installation and commissioning. In case of orders placed on FOB/FCA basis, the purchaser shall arrange Insurance. If orders placed on CIF/CIP basis, the insurance should be up to SVSU, Gurugram Campus.

4.23 **Warranty:**

(i) Warranty period shall be (as stated at "Schedule "of this tender) from date of installation of Goods and acceptance at SVSU. The Supplier shall, in addition, comply with the performance and/or consumption guarantees specified under the contract. If for reasons attributable to the Supplier, these guarantees are not attained in whole or in part, the Supplier shall at its discretion make such changes, modifications, and/or additions to the Goods or any part thereof as may be necessary in order to attain the contractual guarantees specified in the Contract at its own cost and expense and to carry out further performance tests. The warranty should be comprehensive on site.

(ii) The Purchaser shall promptly notify the Supplier in writing of any claims arising under this warranty. Upon receipt of such notice, the Supplier shall arrange to repair or replace the defective goods or parts within 03 days free of cost in SVSU Gurugram Campus. The Supplier shall take over the replaced parts/goods at the time of their replacement. No claim whatsoever shall lie on the Purchaser for the replaced parts/goods thereafter. The period for correction of defects in the warranty period is 03 days. If the supplier having been notified fails to remedy the defects within 03 days, the purchaser may proceed to take such remedial action as may be necessary, at the supplier's risk and expenses and

without prejudice to any other rights, which the purchaser may have against the supplier under the contract.

(iii) The warranty period should be clearly mentioned. The maintenance charges (AMC) under different schemes after the expiry of the warranty should also be mentioned. The comprehensive warranty will commence from the date of the satisfactory installation/commissioning of the equipment against the defect of any manufacturing, workmanship and poor quality of the components.

4.24 **Governing Language**

The contract shall be written in English language. English language version of the Contract shall govern its interpretation. All correspondence and other documents pertaining to the Contract, which are exchanged by the parties, shall be written in the same language.

4.25 Applicable Law

The Contract shall be interpreted in accordance with the laws of the Union of India and all disputes shall be subject to place of jurisdiction.

4.26 Notices

(i) Any notice given by one party to the other pursuant to this contract/order shall be sent to the other party in writing or by cable, telex, FAX or e mail and confirmed in writing to the other party's address.

(ii) A notice shall be effective when delivered or on the notice's effective date, whichever is later.

4.27 Taxes

Suppliers shall be entirely responsible for all taxes, duties, license fees, octroi, road permits, etc., incurred until delivery of the contracted Goods to the Purchaser. However, GST in respect of the transaction between the Purchaser and the Supplier shall be payable extra, if so stipulated in the order.

4.28 Payment:

For Indigenous supplies, 100% payment shall be made by the Purchaser against delivery, inspection, successful installation, commissioning and acceptance of the equipment at SVSU, Gurugram Campus in good condition and to the entire satisfaction of the Purchaser and on production of unconditional performance bank guarantee as specified in Clause 4.8 of tender terms and conditions.

4.30 User list: Brochure detailing technical specifications and performance, list of industrial and Government educational establishments where the items enquired has been supplied by the Bidder or their OEM/Manufacture has undertaken such work during last three years must be provided. (Ref. Annexure-V)

4.31 Manuals and Drawings:

(i) Before the goods and equipment are taken over by the Purchaser, the Supplier shall supply operation and maintenance manuals. These shall be in such details as will enable the Purchaser to operate, maintain, adjust and repair all parts of the works as stated in the specifications.

(ii) The Manuals shall be in the ruling language (English) in such form and numbers as stated in the contract.

(iii) Unless and otherwise agreed, the goods equipment shall not be considered to be completed for the purposes of taking over until such manuals and drawing have been supplied to the Purchaser.

4.32 Application Specialist: The Tenderer should mention in the Techno-Commercial bid the availability and names of Application Specialist and Service Engineers in the nearest regional office. (Ref. to Annexure-V)

4.33 Site Preparation: The supplier shall inform to the Institute about the site preparation, if any, needed for the installation of equipment, immediately after the receipt of the purchase order. The supplier must provide complete details regarding space and all the other infrastructural requirements needed for the equipment, which the Institute should arrange before the arrival of the equipment to ensure its timely installation and smooth operation thereafter.

The supplier may visit the Institute and see the site where the equipment is to be installed and may offer his advice and render assistance to the Institute in the preparation of the site and other pre-installation requirements.

4.34 **Spare Parts**

The Supplier may be required to provide any or all of the following materials, notifications, and information pertaining to spare parts manufactured or distributed by the Supplier. Such spare parts as the Purchaser may elect to purchase from the Supplier, providing that this election shall not relieve the Supplier of any warranty obligations under the Contract; and In the event of termination of production of the spare parts; Advance notification to the Purchaser of the pending termination, in sufficient time to permit the Purchaser to procure needed requirements; and following such termination, furnishing at no cost to the Purchaser, the blueprints, drawings and specifications of the spare parts, if requested.

Supplier shall carry sufficient inventories to assure ex-stock supply of consumable spares. Other spare parts and components shall be supplied as promptly as possible but in any case within six months of placement of order.

- 4.35 **Defective Equipment:** If any of the equipment supplied by the Supplier is found to be substandard, refurbished, un-merchantable or not in accordance with the description/specification or otherwise faulty, the committee will have the right to reject the equipment or its part. The prices of such equipment shall be refunded by the Supplier with 18% interest if such payments for such equipment have already been made. All damaged or unapproved goods shall be returned at suppliers cost and risk and the incidental expenses incurred thereon shall be recovered from the supplier. Defective part in equipment, if found before installation and/or during warranty period, shall be replaced within 7 days on receipt of the intimation from this office at the cost and risk of supplier including all other charges. In case supplier fails to replace above item as per above terms & conditions, SVSU may consider "Banning" the supplier.

4.36 **Termination for Default**

(i) The Purchaser may, without prejudice to any other remedy for breach of contract, by written notice of default sent to the Supplier, terminate the Contract in whole or part:

- a. If the Supplier fails to deliver any or all of the Goods within the period(s) specified in the order, or within any extension thereof granted by the Purchaser; or
- b. If the Supplier fails to perform any other obligation(s) under the Contract.
- c. If the Supplier, in the judgment of the Purchaser has engaged in corrupt or fraudulent practices in competing for or in executing the Contract.

(ii) For the purpose of this Clause:

- a. **“Corrupt practice”** means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution.
- b. **“Fraudulent practice”** means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practice among Tenderer (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition;”

(iii) In the event the Purchaser terminates the Contract in whole or in part, the Purchaser may procure, upon such terms and in such manner, as it deems appropriate, Goods or Services similar to those undelivered, and the Supplier shall be liable to the Purchaser for any excess costs for such similar Goods or Services. However, the Supplier shall continue the performance of the Contract to the extent not terminated.

- 4.37 **Shifting:** Once our new Academic Block will be ready, the supplier has to shift and reinstall the instrument free of cost (if required).

- 4.38 **Training of Personnel:** The supplier shall be required to undertake to provide the technical training to the personnel involved in the use of the equipment at the Institute premises, immediately after completing the installation of the equipment as per Annexure X
- 4.39 **Compliance certificate:** This certificate must be provided indicating conformity to the technical specifications. (Annexure-III)
- 4.40 **Evaluation of Offer:**
- i. L1 will be decided on the basis of the total as quoted in the price bid.
 - ii. Offer which deviates from the vital conditions (as illustrated below) of the tender shall be rejected:
 - a. Non submission of complete offers.
 - b. Receipt of offers after due date and time and or by email / fax (unless specified otherwise).
 - c. Receipt of offers in open conditions.
 - iii. In case any TENDERER is silent on any clauses mentioned in this tender document, the Institute shall construe that the TENDERER had accepted the clauses as per the invitation to tender.
 - iv. No revision in the terms and conditions quoted in the offer will be entertained after the last date and time fixed for receipt of tenders.

ANNEXURE-III

COMPLIANCE SHEET

TECHNICAL SPECIFICATION

S.NO	Specifications	Quoted Specification with Model no	Compliance (Y/N)
1	Electrical Work Station I An Electrical workstation with interactive sources and integrated software with data acquisition system consisting of instrument panel and working table should be suitable for student to learn and perform various experiments of electronics and Electrical related subject. Measuring instruments should internally electrically connect and should be fitted in the panel such that only front panel and necessary interface area easily accessible to use. Top Structure of Electrical workstation with interactive sources and Integrated software with data acquisition system be made of 1.5mm thick CRC powder quoted pipes with top made up of good quality 19mm thick plywood and converted with 1.8mm off white color mica. The Electrical workstation with interactive sources and Integrated software with data acquisition system working area should be covered by 2mm thick antistatic mat which held student to controls static discharge as static interface or damage to student, equipment and circuitry. 2 he structure of Electrical workstation with interactive sources and integrated software with ata acquisition system should be as follows a) The basic structure should be made of 38x38x1.5 mm CRC powder quoted pipe for sturdiness. b) The overall dimensions of Electrical workstation with interactive sources and Integrated software with data acquisition system should not be made less than W=1200mm d=700mm h=1650mm c) MS draws 03 number 415x290x133mm (HXWXD) and thickness 1.2mm with handle & separate lock on each draws should be provided. d) For the panel station raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS panel strip below it for housing electrical socket and a switch for electrical use. E) Two pole MCB (32 Amp) to be provided for safety of unit. f).The Electrical workstation with interactive sources and integrated software with data acquisition system should work on main supply of 230V AC50 Hz & G) The Electrical workstation with interactive source and integrated software with data acquisition system consist of following accessories; h) Basic Electrical Simulation software single user with hardware lock should be provided which should assist students for topics like basic electricity, Magnetism & Electromagnetism ,AC Circuits, Measuring Instruments and DC Machine, AC Machine. Technical Specifications Electrical Measuring Instruments AC Ammeter (4 Nos.) Type : Digital Range : 10A AC Voltmeter (4 Nos.) Type : Digital Range : 450Vrms DC Ammeter (4 Nos.) Type : Digital Range : 30A DC Voltmeter (4 Nos.) Type : Digital Range : 300V Single Phase Wattmeter (2 Nos.) Type : Digital Range : 4kW DC Supply (for excitation purpose only) Voltage : 300V ± 10% Current : 2Amp Protective Devices Three Phase MCB (TPN) : 2 Nos. Interconnections : 4mm BS-10 Safety Terminals		

	Single Phase Capacitor Start Induction Motor • Study of Operational Working and Principle of Single Phase Induction Motor • Study of Running and Reversing of Single Phase Induction Motor • Study of the No-Load Test in a Single Phase Induction Motor • Study of the Blocked Rotor Test in a Single Phase Induction Motor • Study of Load Test in a Single Phase Induction Motor Three-phase Squirrel Cage Induction Motor • Study of Operational Working and Principle of Three Phase Squirrel Cage Induction Motor • Study of Running and Reversing of Three Phase Induction Motor • Study of No Load Test performed in a Three Phase Induction Motor • Study of Block Rotor Test performed in a Three Phase Induction Motor • Study of Speed-Torque characteristics in a Three Phase Induction Motor Three Phase Salient Pole Synchronous Motor • Study of Operational Working and Principle of Three Phase Synchronous Motor • Study of V curve of Three Phase Synchronous Motor • Study of Inverse V curve of the Three Phase Synchronous Motor Single Phase Transformer • Study of Open Circuit test of Single-Phase Transformer • Study of Short Circuit Test of Single-Phase Transformer Machine Specification <u>Type : Three Phase Squirrel Cage Induction Motor</u> Power Rating : 1HP Voltage Rating : 415V AC $\pm$ 5%, 50Hz Rated Speed : 1440RPM $\pm$ 7.5% Insulation : Class 'B' Loading arrangement : Mechanical Spring Balance : 2 Nos. (Tubular Type) Brake Drum/Pulley : Aluminium casted with heat suppression Facility Machine Base : "C" Channel Protection : Fuses (mounted at the terminal box of the Machines) <u>Type : Single phase Capacitor Start Induction Motor</u> Power Rating : 1HP Voltage Rating : 220V AC $\pm$ 5%, 50Hz Rated Speed : 1440RPM $\pm$ 7.5% Insulation : Class 'B' Loading arrangement : Mechanical Spring Balance : 2 Nos. (Tubular Type) Brake Drum/Pulley : Aluminium casted with heat suppression facility Machine Base : "C" Channel Protection : Fuses (mounted at the terminal box of the Machines) <u>Single Phase Transformer</u> Mains Supply : Single Phase, 230V AC $\pm$10%, 50Hz Rating : 1kVA Primary Voltage : 0-125V, 0-125V Secondary Voltage : 0-125V, 0-125V Rated Current : 5A <u>Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base Three Phase Synchronous Machine</u> Type : Salient Type Power Rating : 3 HP Voltage Rating : 415V AC $\pm$ 10%, 50Hz Configuration : "Delta" Connected Rated Speed : 1500RPM $\pm$ 5% Insulation : Class 'B' Type : Shunt Power Rating : 2HP Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' Loading Arrangement : Electrical Type of Coupling : Flexible "Lovejoy" Coupling		
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	Machine Base : "C" Channel Protection : Fuses (mounted at the terminal box of the Machines) <u>Single and Three Phase Resistive Load Single Phase Operation</u> Voltage : 240V AC $\pm 10\%$, 50Hz Current : 15A Power : 3.5kW Loading steps : 15 Three Phase Star Operation Voltage : 415V AC $\pm 10\%$, 50Hz Current : 5A (per Phase) Power : 3.5kW Loading steps : 5 (per Phase) Three Phase Delta Operation Voltage : 415V AC $\pm 10\%$, 50Hz Current : 15A (per Phase) Power : 10.5kW Loading steps : 5 (per Phase) Switching Technique : Star/Delta Switch, 415V, 25A Mains MCB : 16A (TPN) <u>Single Phase Variac</u> Type : Close Type Operating Rating : 230V AC $\pm 10\%$, 50Hz Output Voltage : 0 - 270V AC $\pm 10\%$, 50Hz Current : 10A <u>Three Phase Variac</u> Type : Close Type Operating Rating : 415V AC $\pm 10\%$, 50Hz Output Voltage : 0 - 470V AC $\pm 10\%$, 50Hz Current : 10A <u>2.8A, 220 Ohm Rheostats</u> Electrical Work Station II An Electrical workstation with interactive sources and integrated software with data acquisition system consisting of instrument panel and working table should be suitable for student to learn and perform various experiments of electronics and Electrical related subject. Measuring instruments should internally electrically connect and should be fitted in the panel such that only front panel and necessary interface area easily accessible to use. Top Structure of Electrical workstation with interactive sources and Integrated software with data acquisition system be made of 1.5mm thick CRC powder quoted pipes with top made up of good quality 19mm thick plywood and converted with 1.8mm off white color mica. The Electrical workstation with interactive sources and Integrated software with data acquisition system working area should be covered by 2mm thick antistatic mat which held student to controls static discharge as static interface or damage to student, equipment and circuitry. The structure of Electrical workstation with interactive sources and integrated software with data acquisition system should be as follows a) The basic structure should be made of 38x38x1.5 mm CRC powder quoted pipe for sturdiness. b) The overall dimensions of Electrical workstation with interactive sources and Integrated software with data acquisition system should not be made less than W=1200mm d=700mm h=1650mm c) MS draws 03 number 415x290x133mm (HXWxD) and thickness 1.2mm with handle & separate lock on each draws should be provided. d) For the panel station raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS panel strip below it for housing electrical socket and a switch for electrical use. e) Two pole MCB (32 Amp) to be provided for safety of unit. f) The Electrical workstation with interactive sources and integrated software with data acquisition system should work on main supply of 230V AC 50 Hz & g) The Electrical workstation with interactive source and integrated software with data acquisition system consist of following accessories; h) Basic Electrical Simulation software single user with hardware lock should be provided which should assist students for topics like basic electricity, Magnetism & Electromagnetism, AC Circuits, Measuring Instruments and DC Machine, AC Machine. Technical Specifications Electrical Measuring Instruments AC Ammeter (4 Nos.) Type : Digital Range : 10A AC Voltmeter (4 Nos.) Type : Digital		
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Range : 450Vrms DC Ammeter (4 Nos.) Type : Digital Range : 30A DC Voltmeter (4 Nos.) Type : Digital Range : 300V Single Phase Wattmeter (2 Nos.) Type : Digital Range : 4kW DC Supply (for excitation purpose only) Voltage : 300V $\pm$ 10% Current : 2Amp Protective Devices Three Phase MCB (TPN) : 2 Nos. Interconnections : 4mm BS-10 Safety Terminals <u>DC Shunt Wound Motor</u> • Study of No Load Characteristic of DC Shunt Motor • Study of Load Characteristic of DC Shunt Motor • Study of speed control of DC Shunt Motor using armature voltage control and flux field control method <u>DC Shunt Wound Generator</u> • Study of Operational Working and Principle of DC Shunt Generator • Study and measurement of Open Circuit Characteristic of DC Shunt Generator • Study and measurement of Load Characteristic of DC Shunt Generator • <u>Hopkinson's test on dc shunt machines</u> <u>DC Series Wound Generator</u> Study and verify the Field Test of DC Series Machine Technical Specifications Machine Specification Type : Shunt Power Rating : 1 HP Voltage Rating : 220V DC $\pm$ 5% Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' Loading arrangement : Mechanical Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base DC Machine (acts as prime mover) Type : Shunt Voltage Rating : 220V DC $\pm$ 5% Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' DC Machine (acts as generator) Type : Shunt Power Rating : 0.5HP Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' Shaft extension : Single Sided Loading Arrangement : Electrical Type of Coupling : Flexible "Lovejoy" Coupling Machine Base : "C" Channel Protection : Fuses (mounted at the terminal box of the Machines) Both the Machines are flexibly coupled and Mounted on a Single 'C' Channel Base DC Machine (acts as prime mover) Type : Series Voltage Rating : 220V DC $\pm$ 5% Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' DC Machine (acts as generator) Type : Series Power Rating : 0.5HP Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' Shaft extension : Single Sided Loading Arrangement : Electrical Type of Coupling : Flexible "Lovejoy" Coupling Machine Base : "C" Channel Protection : Fuses (mounted at the terminal box of the Machines) Both the identical Machines are flexibly coupled and Mounted on a Single 'C' Channel Base Type : Shunt (2Nos)		
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	Voltage Rating : 220V DC $\pm$ 5% Rated Speed : 1500RPM $\pm$ 7.5% Insulation : Class 'B' Loading Arrangement : Electrical Type of Coupling : Flexible "Lovejoy" Coupling Machine Base : "C" Channel Protection : Fuses (mounted at the terminal box of the Machines) Single and Three Phase Resistive Load Single Phase Operation Voltage : 240V AC $\pm$10%, 50Hz Current : 15A Power : 3.5kW Loading steps : 15 Three Phase Star Operation Voltage : 415V AC $\pm$10%, 50Hz Current : 5A (per Phase) Power : 3.5kW Loading steps : 5 (per Phase) Three Phase Delta Operation Voltage : 415V AC $\pm$10%, 50Hz Current : 15A (per Phase) Power : 10.5kW Loading steps : 5 (per Phase) Switching Technique : Star/Delta Switch, 415V, 25A Mains MCB : 16A (TPN) DC Power Supply Input Mains : 230V AC $\pm$10%, 50Hz DC Output Voltage Fixed : 220V $\pm$10%, 2A Variable : 0-220V $\pm$10%, 12A Digital Voltmeter : 300V Digital Ammeter : 20A Single Phase MCB : 16A 2.8A, 220 Ohm Rheostats (2 Nos) 0.8A, Rheostats Analog Electronics Workbench I An integrated Workbench consisting of instrument panel and working table on which students should be able to learn and perform experiments. The instruments should to be fitted in the panel such that only the front panel is accessible & they are internally electrically connected. The Workbench should be made of M.S. powder coated tubular steel pipes with top made up of good quality 19 mm thick plywood with 1.8 mm off white colour laminate covered with antistatic mat protect workbench top from hot soldering iron on the working area. <u>The Technical details of Workbench are as under:</u> 1.The basic structure should be made of 30 x 30 x 1.5 mm tubular mild steel pipes 2. The MS sheet used in pipes should be min. 1.5 mm in thickness for sturdiness 3. The overall dimensions of Workbench should not be less than W = 1200 mm; D = 750 mm; H = 1150 mm 4. 3 nos. - MS drawers with handle & separate lock on each drawer should be provided 5. Fixed levelling screws on the base of the legs should be provided 6. For the panel section, raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS Panel strip below it for housing Electrical Sockets and Switches for external use. 7. 2 Pole MCB (32A) to be provided for safety of Workbench 8. Workbench should work on Mains Supply - 230V AC, 50 Hz <u>Technical specifications of instruments and facility to be installed on the Workbench should be as under:</u> Workbench should have the following key features: 5) <u>50 Mhz 4 Channel Digital Storage Oscilloscope</u>		
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	50MHz 4 analog Channel Digital Storage Oscilloscope, the oscilloscope should support real time sampling analog channel: 1 GSa/s, Memory Depth should be: 20Mpts, vertical range 1mV/div -10V / div, horizontal range 5ns/div to 50 s/div, the instrument should have triggering facility including edge, pulse, window, slope, RS232/UART, I2C, SPI, it should also have automatic measurements facility and 6 bits hardware counter, 6.5" inch TFT Display, Math functions like A+B, A-B, A×B, A/B, FFT, A&&B, A B, A^B, A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs., computer connectivity USB Host & USB Device and LAN. 6) <u>2 Channel 25 MHz Arbitrary Waveform Generator</u> Sine: 1 µHz - 25 MHz, Square: 1 µHz - 10 MHz, Pulse: 1 µHz - 10 MHz, Ramp: 1 µHz - 500 kHz, Arb: 1 µHz - 10 MHz, Sampling Rate 125MSa/Sec, Memory 2Mpts, other waveform including Noise, Display 4.3 inch TFT LCD with touch screen, Vertical Resolution 16 bits, Built in 7 digit 240MHz frequency counter, Amplitude 1mVpp to 10Vpp, Modulation AM,FM,PM,ASK,FSK,PSK,PWM, Liner/Logarithmic Sweep Mode, Burst Mode, computer connectivity USB Host & USB Device. 7) <u>DC Programmable Power Supply</u> Channels: 3 ,Voltage/Current:CH1: 0 ~ 30V/0 ~ 3A,CH2: 0 ~ 30V/0 ~ 3A,CH3: 0 ~ 5V/0 ~ 3A Over Voltage Protection : Should be available, Over Current Protection : Should be available Load Regulation : Voltage: < 0.02% + 2mV,Current: < 0.02% + 250µA Linear Regulation: Voltage: < 0.02% + 2mV,Current: < 0.02% + 250µA Ripples and Noise(20 Hz to 20 MHz) :Normal Mode Voltage: < 400µVrms/3mVpp Accuracy : a. Voltage CH1: 0.05% + 20mV,CH2: 0.05% + 20mV,CH3: 0.1% + 5mV Current :CH1: 0.2% + 5mA,CH2: 0.2% + 5mA,CH3: 0.2% + 5mA Resolution :Voltage: 10mV, Current: 1mA Independent control for each channel Display: 3 inch TFT Interface: USB Host, USB Device 8) <u>5 1/2 Digit Digital Multimeter</u> • 5 ½ digits • Measurement Functions: DC Voltage, AC Voltage, DC Current, AC Current, 2-wire Resistance, 4-wire Resistance, CAP, Diode, Connectivity, Frequency, Period, Any Sensor • Measurement Range: - DC Voltage: 200 mV to 1000 V - AC Voltage: 200 mV to 750 V - DC Current: 200 µA to 10 A - AC Current: 20 mA to 10 A - Resistance: 200 Ω to 100 MΩ - CAP : 2nF to 100 mF - Diode : 2V - Connectivity: 2000 Ω - Frequency : 20 Hz to 1MHz Interface : USB Host, USB Device <u>Technical Specifications of plug and play modules for Analog electronics experimentation are as under:-</u> Diode Characteristics The trainer should have following features : A complete system to study the diode characteristics Forward and reverse characteristics experiment Silicon, Zener and Germanium diode Ammeter and Voltmeter for measurement Different test points Manual with theoretical and practical details		
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	The trainer should have following Technical Specifications : <table><tr><td>On Board DC power supply</td><td>:</td><td>+12V DC</td></tr><tr><td>Ammeter</td><td></td><td></td></tr><tr><td>Range</td><td>:</td><td>1μA to 200mA</td></tr><tr><td>Display</td><td>:</td><td>3½ digit</td></tr><tr><td>Voltmeter</td><td></td><td></td></tr><tr><td>Range</td><td>:</td><td>1mV to 200V</td></tr><tr><td>Display</td><td>:</td><td>3½ digit</td></tr><tr><td>Mains power</td><td>:</td><td>230V AC ±10%</td></tr></table> The trainer should performed following experiments : Study of V-I characteristics of Silicon Diode Study of V-I characteristics of Zener Diode Study of V-I characteristics of Light Emitting Diode (LED) Transistor Characteristics The trainer should have following features : A complete system to study the Transistor characteristics On board DC power supplies In-built Ammeter and Voltmeter Different test points Three important characteristics of a Transistor Input characteristic Output characteristic Constant current transfer characteristic Manual with theoretical and practical details The trainer should have following Technical Specifications : <table><tr><td>DC power supply</td><td>:</td><td>+5 V, -5 V+12 V, -12 V</td></tr><tr><td>Transister</td><td>:</td><td>BC548, 2N3906</td></tr><tr><td>Ammeter</td><td></td><td></td></tr><tr><td>Range</td><td>:</td><td>1μA to 200 mA</td></tr><tr><td>Display</td><td>:</td><td>3½ digit</td></tr><tr><td>Voltmeter</td><td></td><td></td></tr><tr><td>Range</td><td>:</td><td>1mV to 200 V</td></tr><tr><td>Display</td><td>:</td><td>3½ digit</td></tr><tr><td>Mains</td><td>:</td><td>230 V AC ±10%</td></tr></table> The trainer should performed following experiments : Study of the characteristics of PNP transistor in Common Base Configuration and to evaluate - Input resistance, Output resistance and Current gain. Study of the characteristics of PNP transistor in Common Collector Configuration and to evaluate - Input resistance, Output resistance and Current gain. Study the characteristics of NPN transistor in common Emitter Configuration and to evaluate - Input resistance, Output resistance and Current gain. Study of the characteristics of NPN transistor in Common Base configuration and to evaluate - Input resistance, Output resistance and Current gain. Study of the characteristics of NPN transistor in Common Collector configuration and to evaluate - Input resistance, Output resistance and Current gain. Study the characteristics of PNP transistor in Common Emitter Configuration and to evaluate - Input resistance, Output resistance and Current gain. Rectifier training system The trainer should have following features : A complete system to study the Rectifier Real time appearance of components Test points in different sections of power supply Designed by considering all the safety standards Manual with theoretical and practical details The trainer should have following Technical Specifications : <table><tr><td>Transformer Rating</td><td>:</td><td>9 V center tapped (300 mA) approx.</td></tr><tr><td>Mains Supply</td><td>:</td><td>230 V, ±10%, 50 Hz</td></tr><tr><td>Half wave Rectifier output</td><td>:</td><td>+ 4 V DC approx.</td></tr><tr><td>Center-Trapped Rectifier</td><td>:</td><td>+8 V DC approx.</td></tr><tr><td>Bridge Rectifier Output</td><td>:</td><td>+ 8 V DC approx.</td></tr><tr><td>Filter</td><td>:</td><td>LC Type</td></tr><tr><td>Load</td><td>:</td><td>Resistive 220 W</td></tr></table> The trainer should performed following experiments : Study of Half-wave Rectifier Study of Full-wave Center-tapped Rectifier	On Board DC power supply	:	+12V DC	Ammeter			Range	:	1μA to 200mA	Display	:	3½ digit	Voltmeter			Range	:	1mV to 200V	Display	:	3½ digit	Mains power	:	230V AC ±10%	DC power supply	:	+5 V, -5 V+12 V, -12 V	Transister	:	BC548, 2N3906	Ammeter			Range	:	1μA to 200 mA	Display	:	3½ digit	Voltmeter			Range	:	1mV to 200 V	Display	:	3½ digit	Mains	:	230 V AC ±10%	Transformer Rating	:	9 V center tapped (300 mA) approx.	Mains Supply	:	230 V, ±10%, 50 Hz	Half wave Rectifier output	:	+ 4 V DC approx.	Center-Trapped Rectifier	:	+8 V DC approx.	Bridge Rectifier Output	:	+ 8 V DC approx.	Filter	:	LC Type	Load	:	Resistive 220 W		
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Ammeter																																																																											
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Filter	:	LC Type																																																																									
Load	:	Resistive 220 W																																																																									

	Study of Full-wave Bridge Rectifier Calculation of Ripple Factor and Efficiency of various Rectifier Wein bridge Oscillator training system The trainer should have following features : Exclusive and compact design. Straight forward representation of Wein Bridge Oscillator. inbuilt power supply. Designed with considering all the safety standards. Manual with theoretical and practical details The trainer should have following Technical Specifications : Biasing Voltage : +12V,-12V Design of Oscillator : Passive Element with OP- The trainer should performed following experiments : Study of design and functioning of Wein Bridge Oscillator Zener Diode Voltage Regulator training system The trainer should have following features : A complete system to study the diode characteristics Different test points Manual with theoretical and practical details The trainer should have following Technical Specifications : mains Supply : 230 V $\pm 10\%$, 50 Hz Transformer : 0 - 9 V, 500 mA (approx.) Filter : Capacitive 1000 μF, 35 V Zener Diode : $V_z = 5.6$ V I_{ZM} = 178 mA Potentiometer, P1 : 4.7 KW Potentiometer, P2 : 4.7 KW The trainer should performed following experiments : Study of Zener Diode as a Voltage Regulator, when input voltage, V_{in} is fixed while load resistance R_L is variable. Study of Zener Diode as a Voltage Regulator, when input voltage, V_{in} is variable while load resistance R_L is fixed Experimentation with BJT Amplifiers and Emitter Follower training system To study the operation of single stage and multi stage RC–Coupled amplifier To plot the frequency response of RC–Coupled amplifier To calculate the current gain and input impedance of Darlington pair and β of a transistor o calculate the voltage gain of Darlington pair using voltage divider biasing DC power supply : +12V, +5V Fuse : 500mA, slow blow Sine wave generator Frequency : 10Hz - 100kHz $\pm 10\%$ Amplitude : 0 to 5V_{pp} Mains supply : 230V $\pm 10\%$, 50Hz Dimensions (mm) : W 240 x D 345 x H 110 Basic analog electronics Simulation software single user with hardware lock should be provided which should assist students for topics like Basic Electrical Concepts Basic Circuits Fundamentals of Resistor/Capacitor/Inductor Transformers Semiconductors & Diodes Transistor & basic transistor circuits Operational Amplifiers (Op Amps): Characteristics & Specifications Practical Op-Amp circuits Power Supplies & Rectifiers Analog Electronics Workbench II An integrated Workbench consisting of instrument panel and working table on which students should be able to learn and perform experiments. The instruments should to be fitted in the panel such that only the front panel is accessible & they are internally electrically connected. The Workbench should be made of M.S. powder coated tubular steel pipes with top made up of good quality 19 mm thick plywood with 1.8 mm off white colour laminate covered with antistatic mat protect workbench top from hot soldering iron on the working area. <u>The Technical details of Workbench are as under:</u> 1.The basic structure should be made of 30 x 30 x 1.5 mm tubular mild steel pipes 2. The MS sheet used in pipes should be min. 1.5 mm in thickness for sturdiness		
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	3. The overall dimensions of Workbench should not be less than W = 1200 mm; D = 750 mm; H = 1150 mm 4. 3 nos. - MS drawers with handle & separate lock on each drawer should be provided 5. Fixed levelling screws on the base of the legs should be provided 6. For the panel section, raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS Panel strip below it for housing Electrical Sockets and Switches for external use. 7. 2 Pole MCB (32A) to be provided for safety of Workbench 8. Workbench should work on Mains Supply - 230V AC, 50 Hz Technical specifications of instruments and facility to be installed on the Workbench should be as under: Workbench should have the following key features: 5) <u>50 Mhz 4 Channel Digital Storage Oscilloscope</u> 50MHz 4 analog Channel Digital Storage Oscilloscope, the oscilloscope should support real time sampling analog channel: 1 GSa/s, Memory Depth should be: 20Mpts, vertical range 1mV/div -10V / div, horizontal range 5ns/div to 50 s/div, the instrument should have triggering facility including edge, pulse, window, slope, RS232/UART, I2C, SPI, it should also have automatic measurements facility and 6 bits hardware counter, 6.5" inch TFT Display, Math functions like A+B, A-B, A×B, A/B, FFT, A&&B, A B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs., computer connectivity USB Host & USB Device and LAN. 6) <u>2 Channel 25 MHz Arbitrary Waveform Generator</u> Sine: 1 µHz - 25 MHz, Square: 1 µHz - 10 MHz, Pulse: 1 µHz - 10 MHz, Ramp: 1 µHz - 500 kHz, Arb: 1 µHz - 10 MHz, Sampling Rate 125MSa/Sec, Memory 2Mpts, other waveform including Noise, Display 4.3 inch TFT LCD with touch screen, Vertical Resolution 16 bits, Built in 7 digit 240MHz frequency counter, Amplitude 1mVpp to 10Vpp, Modulation AM,FM,PM,ASK,FSK,PSK,PWM, Liner/Logarithmic Sweep Mode, Burst Mode, computer connectivity USB Host & USB Device. 7) <u>DC Programmable Power Supply</u> Channels: 3 ,Voltage/Current:CH1: 0 ~ 30V/0 ~ 3A,CH2: 0 ~ 30V/0 ~ 3A,CH3: 0 ~ 5V/0 ~ 3A Over Voltage Protection : Should be available, Over Current Protection : Should be available Load Regulation : Voltage: < 0.02% + 2mV,Current: < 0.02% + 250µA Linear Regulation: Voltage: < 0.02% + 2mV,Current: < 0.02% + 250µA Ripples and Noise(20 Hz to 20 MHz) :Normal Mode Voltage: < 400µVrms/3mVpp Accuracy : a. Voltage CH1: 0.05% + 20mV,CH2: 0.05% + 20mV,CH3: 0.1% + 5mV Current :CH1: 0.2% + 5mA,CH2: 0.2% + 5mA,CH3: 0.2% + 5mA Resolution :Voltage: 10mV, Current: 1mA Independent control for each channel Display: 3 inch TFT Interface: USB Host, USB Device 8) <u>5 ^{1/2} Digit Digital Multimeter</u> • 5 ½ digits • Measurement Functions: DC Voltage, AC Voltage, DC Current, AC Current, 2-wire Resistance, 4-wire Resistance, CAP, Diode, Connectivity, Frequency, Period, Any Sensor • Measurement Range:		
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	DC Voltage: 200 mV to 1000 V AC Voltage: 200 mV to 750 V DC Current: 200 μA to 10 A AC Current: 20 mA to 10 A Resistance: 200 Ω to 100 MΩ CAP : 2nF to 100 mF Diode : 2V Connectivity: 2000 Ω Frequency : 20 Hz to 1MHz Interface : USB Host, USB Device <u>Technical Specifications of plug and play modules for Analog electronics experimentation are as under:-</u> <u>SMPS Trainering steup</u> Trainer should have following features LCD Display to various relevant experiment parameters. Facility to measure signals on Oscilloscope Isolated Power supply for Input to avoid Shock Hazard Diagrammatic representation of circuit for better understanding Test Points should provided to observe signals at various stages Fault identification switches for fault analysis Protective shield to prevent shock Should designed considering all safety standards The training setup should have following specifications <table> <tr> <td>Input</td> <td>85 to 230V AC, 50Hz</td> </tr> <tr> <td>Output</td> <td>+12V DC regulated -12V DC regulated +5V DC regulated</td> </tr> </table> Switching Transformer <table> <tr> <td>Input</td> <td>320V DC switching at 120KHz or above</td> </tr> <tr> <td>Output</td> <td>30V AC</td> </tr> </table> Experiment can be performed Study of Primary rectifier and Filter section Study of Switching Transformer Study of Optocoupler Study of Regulation Study of SMPS with Variac input (Variable AC)-Regulation Test Study of various faults and procedure of their trouble shooting Clipper and Clamper training system The trainer should have following features : A complete system to study the Clipper & Clamper Different test points Manual with theoretical and practical details The trainer should have following Technical Specifications : Mains Supply : 230 V $\pm$10%, 50 Hz Sine Wave Generator : 1 KHz, 15V Vpp (approx.) DC Power Supply : 0 - 5 V (vary through rotary switch for specific voltage level) The trainer should performed following experiments : Study of Series Positive Clipper and Series Negative Clipper Circuits Study of Shunt Positive Clipper and Shunt Negative Clipper Circuits Study of Biased Series Positive Clipper and Biased Series Negative Clipper Circuits Study of Biased Shunt Positive Clipper and Biased Shunt Negative Clipper Circuits Study of Combination Clipper Circuit Study of Positive and Negative Clamper Circuits Study of Biased Clamper Circuits Understanding Characteristics of MOSFET, FET and UJT To study and plot the Drain Characteristics of n channel MOSFET To study and plot the Transfer Characteristics of n channel MOSFET To study and plot the V-I characteristics of JFET Evaluation of following parameters of JFET: -DC Drain resistance -Trans conductance -Amplification factor To plot the VI characteristics of UJT Evaluation of following parameters of UJT: -Intrinsic Stand- off Ratio -Inter base resistance	Input	85 to 230V AC, 50Hz	Output	+12V DC regulated -12V DC regulated +5V DC regulated	Input	320V DC switching at 120KHz or above	Output	30V AC		
Input	85 to 230V AC, 50Hz										
Output	+12V DC regulated -12V DC regulated +5V DC regulated										
Input	320V DC switching at 120KHz or above										
Output	30V AC										

	Technical Specifications Mains Supply : 90-230V, 50Hz DC Fixed Power Supply : -5V, +15V, +35V DC Variable Power Supply :1.5V to 14 V 1.5V to 34V Voltmeter : 0-200V Ammeter : 0-200mA Bread Board Dimension (mm) : 175 x 61 x 10 Distribution strips : 2 Distribution holes : 200 Terminal Strips : 1 Terminal holes : 640 Resistor Bank : M.F.R. 100E 1W (3 Nos.) M.F.R. 470E 1W (3 Nos.) M.F.R. 1K 1W(3 Nos.) Variable Resistances : 5 K? Ten turn Potentiometer (1 No.) 10 K? Ten turn Potentiometer (1 No.) 5 Kohm Single turn Potentiometer (1 No.) Fuse : 500 mA, slow blow Dimensions (mm) : 350 x D 280 x H 55 Operational Amplifier Lab training system Inverting Amplifier Non - inverting Amplifier Buffer Comparator Adder Subtract or Square Wave Generator Differentiator and its working as High Pass Filter Integrator and its working as Low Pass Filter Logarithmic Amplifier Voltage Controlled Current Source Current Controlled Voltage Source Technical specification Mains Power Supply : 90 - 270V $\pm 10\%$, 50Hz (SMPS) Fixed DC Power Supply : +12V, Regulated -12V, Regulated +5V, Regulated -5V, Regulated Variable DC Power Supply : +1.5V to +10V Regulated : -1.5V to -10V Regulated Function Generator Sine Wave Frequency : 1KHz to 100KHz Frequency Control : 100KV, 10 turn Potentiometer Amplitude : 0V to 5Vpp Amplitude Control : 100KV, Single turn Potentiometer Triangular Wave Frequency : 1KHz to 100KHz Frequency Control : 100KV, 10 turn Potentiometer Amplitude : 0V to 5Vpp Amplitude Control : 100KV, Single turn Potentiometer Square Wave Frequency : 1KHz to 100KHz Frequency Control : 100KV, 10 turn Potentiometer Amplitude : 5Vpp, fixed Bread Board Dimension(mm) : 175 x 61 x 10 Distribution strips : 2 Distribution holes : 200 Terminal holes : 640 Op-Amp : IC uA741 (2 nos.) : All pins terminated on 2 mm Banana Sockets Supply Voltage : $\pm 22V$ max. Differential Input Voltage : $\pm 30V$ max. Input Voltage : $\pm 15V$ max. Slew Rate : 0.5 V/μs (VCC = $\pm 15V$) Resistor Bank SMD Resistance 1KV 1% 1/4W (5 nos.) SMD Resistance 10KV 1% 1/4W (5 nos.) SMD Resistance 100KV 1% 1/4W (5 nos.) Diode : Diode 1N 4007 Capacitor Bank : Electrolyte 1mf/63V Disc 1nf/63V Disc 10nf/63V Disc 100nf/63V Variable Resistance Bank 1KV Single turn Potentiometer (2 nos.) 10KV Single turn Potentiometer (2 nos.) 100KV Single turn Potentiometer (2 nos.) 1MV Single turn Potentiometer (2 nos.) Fuse : 500mA, slow blow Dimensions (mm) : W 350 x D 280 x H 55 Basic analog electronics Simulation software single user with hardware lock should be provided which should assist students for topics like Basic Electrical Concepts Basic Circuits Fundamentals of Resistor/Capacitor/Inductor Transformers Semiconductors & Diodes Transistor & basic transistor circuits Operational Amplifiers (Op Amps): Characteristics & Specifications Practical Op-Amp circuits Power Supplies & Rectifiers Rectifier training system Real time appearance of components Test points are provided in different sections of Power Supply Demonstration bridge Designed by considering all the safety standards Provided with a detailed Operating manual Low cost yet including many experiments Input : 230 V $\pm 10\%$, 50 Hz Outputs Zener diode outputs : 10 V, 5.6 V regulated Regulators outputs : +12 V regulated -12 V regulated 1.8 to 17 V adjustable Load : 5 K variable with 1 K fixed resistance. Bleeder Resistor : 5 K variable with 1 K fixed resistance. Astable Multivibrator : 1 Hz, 14 Vpp Transformer : Primary 0 to 220 V Secondary : 18-0-18, 6-0-6 (500 mA) Fuse : 500 mA (slow blow, spare fuse is given in mains socket) Study of Transformers and its working Study of Two diode Full Wave Rectifier Study of Full Wave Bridge Rectifier Study of Demonstration Bridge Study of Ripple Factor and to calculate Ripple Factor of Half Wave,		
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	Full Wave and Bridge Rectifier Study of LC and π filter Study of Bleeder Resistor and its effect on load current Study of Zener Diode as Regulator Study of Positive Regulated Supply Study of Negative Regulated Supply Study of Adjustable Regulated Supply Study of Line Regulation Study of Load Regulation Essential accessories:- DC Power Supply : 5V, 200mA AC Power Supply : 6V, 1A Relay : 5V Galvanometer : 30 - 0 - 30 Galvanometer Resistance : 80W Light Bulbs : 6V Potentiometers : 25W, 1W, 10kW, 1W Switch : 1 Pole, 2 Way Toggle type Core Types : E, I, U Training System Includes • Components box with a. Resistors b. Capacitors c. Transistors d. Diode e. Potentiometer E, I, U cores Set of coils Magnetic compass Bar magnets Screw driver Connection patch cords Digital Electronics Workbench I An integrated Workbench consisting of instrument panel and working table on which students should be able to learn and perform experiments. The instruments should to be fitted in the panel such that only the front panel is accessible & they are internally electrically connected. The Workbench should be made of M.S. powder coated tubular steel pipes with top made up of good quality 19 mm thick plywood with 1.8 mm off white colour laminate covered with antistatic mat protect workbench top from hot soldering iron on the working area. The Technical details of Workbench are as under: 1.The basic structure should be made of 30 x 30 x 1.5 mm tubular mild steel pipes 2. The MS sheet used in pipes should be min. 1.5 mm in thickness for sturdiness 3. The overall dimensions of Workbench should not be less than W = 1200 mm; D = 750 mm; H = 1150 mm 4. 3 nos. - MS drawers with handle & separate lock on each drawer should be provided 5. Fixed levelling screws on the base of the legs should be provided 6. For the panel section, raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS Panel strip below it for housing Electrical Sockets and Switches for external use. 7. 2 Pole MCB (32A) to be provided for safety of Workbench 8. Workbench should work on Mains Supply - 230V AC, 50 Hz Technical specifications of instruments and facility to be installed on the Workbench should be as under: Workbench should have the following key features: 4. 70MHz, Mix Signal Oscilloscope 70MHz 4 analog Channel and 16 digital channel, the oscilloscope should support real time sampling analog channel: 1 GSa/s, Memory Depth should be: 20Mpts, vertical range 1mV/div -10V / div, horizontal range 5ns/div to 50 s/div, the instrument should have triggering facility including edge, pulse, window, slope, RS232/UART, I2C, SPI, it should also have automatic measurements facility and 6 bits hardware counter, 6.5" inch TFT Display, Math functions like A+B, A-B, A×B, A/B, FFT, A&&B, A B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs., computer connectivity USB Host & USB Device and LAN. 5. 5 ^{1/2} Digit Digital Multimeter • 5 ½ digits • Measurement Functions: DC Voltage, AC Voltage, DC Current, AC Current, 2-wire Resistance, 4-wire Resistance, CAP, Diode, Connectivity, Frequency,		
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	Period, Any Sensor - Measurement Range: DC Voltage: 200 mV to 1000 V AC Voltage: 200 mV to 750 V DC Current: 200 μA to 10 A AC Current: 20 mA to 10 A Resistance: 200 Ω to 100 MΩ CAP: 2nF to 100 mF Diode: 2V Connectivity: 2000 Ω Frequency: 20 Hz to 1MHz Interface: USB Host, USB Device Temperature controlled Soldering and De soldering station with SMD Iron. 6. <u>Project board for digital electronics.</u> Graphical LCD to show the menu of experiment and gate level diagram for selected experiments - More than 46 Digital electronics experiments on single board - Solder less breadboard - On Board DC Power Supply & Pulse Generator - Software Detailed Learning content with teaching and simulation software Technical Specifications : <table> <tr> <td>Size of Breadboard</td><td>:</td><td>Regular</td></tr> <tr> <td>DC Supply</td><td>:</td><td>+5 V/1 A +12V/1A</td></tr> <tr> <td>Clock Frequency</td><td>:</td><td>1 Hz, 100 Hz, 1 KHz, 100 KHz</td></tr> <tr> <td>Amplitude</td><td>:</td><td>3.3 V (TTL)</td></tr> <tr> <td>Duty cycle</td><td>:</td><td>50 %</td></tr> <tr> <td>Graphical LCD</td><td>:</td><td>128 X 64 dots</td></tr> <tr> <td>Pulsar Switches</td><td>:</td><td>2 Nos.</td></tr> <tr> <td>Data switches</td><td>:</td><td>8 Nos. (Toggle switches for both TTL modes)</td></tr> <tr> <td>LED display</td><td>:</td><td>8 Nos. (TTL)</td></tr> <tr> <td>Seven Segment Display</td><td>:</td><td>3 Nos.</td></tr> <tr> <td>Power Supply</td><td>:</td><td>100V - 240V AC, 50Hz</td></tr> <tr> <td>Online Product Tutorial</td><td>:</td><td>Should be provided</td></tr> </table> <u>Technical Specifications of plug and play modules for digital electronics experimentation are as under:-</u> Understanding and Experimentation with Digital IC Training product which provides complete flexibility for hands on learning of a wide range of experiments in digital electronics. This product provides vast learning scope for students to design their own experiments and applications. Students can use digital IC's and connect their Input and Output to design and implement in the circuit. Nvis 6550 can be a part of library and can be issued to students to perform the experiments. <table> <tr> <td>Mains Supply</td><td>:</td><td>90V - 250V, 50Hz</td></tr> <tr> <td>Fixed DC Power Supply</td><td>:</td><td>+12V, -12V, +5V, -5V</td></tr> <tr> <td>Fixed TTL Generator</td><td>:</td><td>1Hz, 10Hz, 100Hz, 1kHz, 10kHz and 100kHz</td></tr> <tr> <td>Pulse Generator</td><td>:</td><td>5V</td></tr> <tr> <td>ZIF Socket</td><td>:</td><td>20 Pins (6 Nos.) 40 Pins (1 No.)</td></tr> <tr> <td>Input Section</td><td>:</td><td>12 toggle switches</td></tr> <tr> <td>Output Section</td><td>:</td><td>12 LED indicator Display : 7 Segment (2 Nos.)</td></tr> <tr> <td>Dimension (mm)</td><td>:</td><td>W 350 x D 280 x H 55</td></tr> </table> Logic Gates The trainer should have following features : - Exclusive and compact design - Straight forward representation of all logic gates - Required inbuilt power supply - Designed by considering all the safety standards - Manual with theoretical and practical details The trainer should have following Technical Specifications : <table> <tr> <td>Input</td><td>:</td><td>+5V DC</td></tr> <tr> <td>Logic levels</td><td>:</td><td>+5V : HIGH (Logic 1)</td></tr> <tr> <td>0V</td><td>:</td><td>LOW (Logic 0)</td></tr> </table>	Size of Breadboard	:	Regular	DC Supply	:	+5 V/1 A +12V/1A	Clock Frequency	:	1 Hz, 100 Hz, 1 KHz, 100 KHz	Amplitude	:	3.3 V (TTL)	Duty cycle	:	50 %	Graphical LCD	:	128 X 64 dots	Pulsar Switches	:	2 Nos.	Data switches	:	8 Nos. (Toggle switches for both TTL modes)	LED display	:	8 Nos. (TTL)	Seven Segment Display	:	3 Nos.	Power Supply	:	100V - 240V AC, 50Hz	Online Product Tutorial	:	Should be provided	Mains Supply	:	90V - 250V, 50Hz	Fixed DC Power Supply	:	+12V, -12V, +5V, -5V	Fixed TTL Generator	:	1Hz, 10Hz, 100Hz, 1kHz, 10kHz and 100kHz	Pulse Generator	:	5V	ZIF Socket	:	20 Pins (6 Nos.) 40 Pins (1 No.)	Input Section	:	12 toggle switches	Output Section	:	12 LED indicator Display : 7 Segment (2 Nos.)	Dimension (mm)	:	W 350 x D 280 x H 55	Input	:	+5V DC	Logic levels	:	+5V : HIGH (Logic 1)	0V	:	LOW (Logic 0)		
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	The trainer should perform following experiments: Study of AND gate and to verify its truth table Study of OR gate and to verify its truth table Study of NOT gate and to verify its truth table Study of NAND gate and to verify its truth table Study of NOR gate and to verify its truth table Study of XOR gate and to verify its truth table Study of XNOR gate and to verify its truth table Experimentation with Universal Gates-Nand and Nor This trainer describes the formation of AND, OR, NOT, NAND, NOR, XOR and XNOR gates using NAND and NOR gates which are called universal gates. The training system is designed in a way that for performing any experiment students have to connect the links by patch cords, thereby enabling students to learn step by step design of each gate using universal gates. Attractive input and output sections are provided on trainer in a manner that multiple experiments can be performed simultaneously. Designing of NOT gate using NAND gate Designing of AND gate using NAND gate Designing of OR gate using NAND gate Designing of NOT gate using NOR gate Designing of AND gate using NOR gate Designing of OR gate using NOR gate • Exclusive and compact design Straight forward representation of Universal Gates +5V SMPS adaptor provided with the trainer for power supply Designed by considering all the safety standards Online product tutorial Low cost trainer including illustration of logic gates design using universal gates Technical Specifications Input : +5V DC Logic levels +5V : HIGH (Logic 1) 0V : LOW (Logic 0) Dimensions (mm) : D 345 × W 240 × H 110 Weight : 1kg (approximate) De-Morgan's Theorem The trainer should have following features: Easy explanation of both the De-Morgan's theorem statements Designed by considering all the safety standards Different test points Manual with theoretical and practical details The trainer should have following Technical Specifications : <table border="0"> <tr> <td>Input</td><td>:</td><td>+5V DC</td><td></td></tr> <tr> <td>Logic levels</td><td>:</td><td>+5V</td><td>: HIGH(Logic 1)</td></tr> <tr> <td>0V</td><td>:</td><td>LOW (Logic 0)</td><td></td></tr> </table> The trainer should performed following experiments : Verifying $(A+B)' = A' \cdot B'$ Verifying $(A \cdot B)' = A' + B'$ Adders and Subtracters The trainer should have following features : A complete system to study the diode characteristics Adaptable illustration of Binary Adders and Subtracters Designed by considering all the safety standards Manual with theoretical and practical details The trainer should have following Technical Specifications : <table border="0"> <tr> <td>Input</td><td>:</td><td>+5 V DC</td><td></td></tr> <tr> <td>Logic levels</td><td>:</td><td>+5 V</td><td>: HIGH(Logic 1)</td></tr> <tr> <td>0 V</td><td>:</td><td>LOW (Logic 0)</td><td></td></tr> </table> The trainer should perform following experiments: Study of Binary Half Adder Study of Binary Full Adder using two Half Adders Study of Binary Half Subtractor Flip-Flop The trainer should have following features: Inbuilt DC power Supply Adaptable illustration of Flip-Flops Compact Design Designed by considering all the safety standard Manual with theoretical and practical details The trainer should have following Technical Specifications: <table border="0"> <tr> <td>Input</td><td>:</td><td>+5V DC</td><td></td></tr> <tr> <td>Logic levels :</td><td></td><td>+5V : HIGH(Logic 1)</td><td></td></tr> <tr> <td></td><td></td><td>0V : LOW (Logic 0)</td><td></td></tr> </table>	Input	:	+5V DC		Logic levels	:	+5V	: HIGH(Logic 1)	0V	:	LOW (Logic 0)		Input	:	+5 V DC		Logic levels	:	+5 V	: HIGH(Logic 1)	0 V	:	LOW (Logic 0)		Input	:	+5V DC		Logic levels :		+5V : HIGH(Logic 1)				0V : LOW (Logic 0)			
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	The trainer should performed following experiments : Study of S-R Flip-Flop and to verify its Transition table Study of J-K Flip-Flop and to verify its Transition table Study of D Flip-Flop and to verify its Transition table Study of T Flip-Flop and to verify its Transition table Parallel Adder and Subtractor Demonstrator DC Power Supply +5V DC Logic levels +5V : High (logic 1) 0V : Low (logic 0) LED indication : LED will be ON for logic high or '1' state and will be OFF for Logic low or '0' state Dimensions (mm) : 345 W x 240 D x 110 H 4-bit/8-bit Binary Addition and Subtraction Easy switching between addition and subtraction modes LEDs for visual indication of input-output and carry out logics Online product tutorial Basic digital electronics Simulation software single user with hardware lock should be provided which should assist students for topics like de morgen's law, basic gates/and/or/not, derived gate nand/nor/Xor, derived X or gate, Binary addition and subtraction (half and full) multiplexer and demultiplexer, decimal to bcd encoder, decimal to excess three encoder, decimal to gray encoder, BCD to DECIMAL DECODER, SEVEN SEGMENT DECODER, up counter, down counter, serial in parallel out shift resistor, Digital Electronics Workbench II An integrated Workbench consisting of instrument panel and working table on which students should be able to learn and perform experiments. The instruments should to be fitted in the panel such that only the front panel is accessible & they are internally electrically connected. The Workbench should be made of M.S. powder coated tubular steel pipes with top made up of good quality 19 mm thick plywood with 1.8 mm off white colour laminate covered with antistatic mat protect workbench top from hot soldering iron on the working area. <u>The Technical details of Workbench are as under:</u> 1.The basic structure should be made of 30 x 30 x 1.5 mm tubular mild steel pipes 2. The MS sheet used in pipes should be min. 1.5 mm in thickness for sturdiness 3. The overall dimensions of Workbench should not be less than W = 1200 mm; D = 750 mm; H = 1150 mm 4. 3 nos. - MS drawers with handle & separate lock on each drawer should be provided 5. Fixed levelling screws on the base of the legs should be provided 6. For the panel section, raised back height of 1200mm from floor with matching height support from the side at a depth 500mm for instrument housing with a MS Panel strip below it for housing Electrical Sockets and Switches for external use. 7. 2 Pole MCB (32A) to be provided for safety of Workbench 8. Workbench should work on Mains Supply - 230V AC, 50 Hz <u>Technical specifications of instruments and facility to be installed on the Workbench should be as under:</u> Workbench should have the following key features: 1.70MHz, Mix Signal Oscilloscope 70MHz 4 analog Channel and 16 digital channel , the oscilloscope should support real time sampling analog channel: 1 GSa/s, Memory Depth should be: 20Mpts, vertical range 1mV/div -10V / div, horizontal range 5ns/div to 50 s/div, the instrument should have triggering facility including edge, pulse, window, slope, RS232/UART, I2C, SPI, it should also have automatic measurements facility and 6 bits hardware counter, 6.5" inch TFT Display, Math functions like A+B, A-B, A×B, A/B, FFT, A&&B, A B, A^B, !A, Intg, Diff, Sqrt, Lg, Ln, Exp, Abs., computer connectivity USB Host & USB Device and LAN. 4. 5 ^{1/2} Digit Digital Multimeter		
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• 5 ½ digits • Measurement Functions: DC Voltage, AC Voltage, DC Current, AC Current, 2-wire Resistance, 4-wire Resistance, CAP, Diode, Connectivity, Frequency, Period, Any Sensor • Measurement Range: DC Voltage: 200 mV to 1000 V AC Voltage: 200 mV to 750 V DC Current: 200 µA to 10 A AC Current: 20 mA to 10 A Resistance: 200 Ω to 100 MΩ CAP: 2nF to 100 mF Diode: 2V Connectivity: 2000 Ω Frequency: 20 Hz to 1MHz Interface: USB Host, USB Device Temperature controlled Soldering and De soldering station with SMD Iron. 5. Project board for digital electronics. Graphical LCD to show the menu of experiment and gate level diagram for selected experiments More than 46 Digital electronics experiments on single board Solder less breadboard On Board DC Power Supply & Pulse Generator Software Detailed Learning content with teaching and simulation software Technical Specifications : <table><tr><td>Size of Breadboard</td><td>:</td><td>Regular</td></tr><tr><td>DC Supply</td><td>:</td><td>+5 V/1 A +12V/1A</td></tr><tr><td>Clock Frequency</td><td>:</td><td>1 Hz, 100 Hz, 1 KHz, 100 KHz</td></tr><tr><td>Amplitude</td><td>:</td><td>3.3 V (TTL)</td></tr><tr><td>Duty cycle</td><td>:</td><td>50 %</td></tr><tr><td>Graphical LCD</td><td>:</td><td>128 X 64 dots</td></tr><tr><td>Pulser Switches</td><td>:</td><td>2 Nos.</td></tr><tr><td>Data switches</td><td>:</td><td>8 Nos. (Toggle switches for both TTL modes)</td></tr><tr><td>LED display</td><td>:</td><td>8 Nos. (TTL)</td></tr><tr><td>Seven Segment Display</td><td>:</td><td>3 Nos.</td></tr><tr><td>Power Supply</td><td>:</td><td>100V - 240V AC, 50Hz</td></tr><tr><td>Online Product Tutorial</td><td>:</td><td>Should be provided</td></tr></table> <u>Technical Specifications of plug and play modules for digital electronics experimentation are as under:-</u> <u>Multiplexer and Demultiplexer</u> The trainer should have following features : A complete system to study the Multiplexer & Demultiplexer Easy illustration of Multiplexer and Demultiplexer LEDs for visual indication of inputs and outputs status SPDT switches for logic selection Manual with theoretical and practical details The trainer should have following Technical Specifications: <table><tr><td>Input</td><td>:</td><td>+5V DC</td><td></td></tr><tr><td>Logic levels</td><td>:</td><td>+5V</td><td>HIGH (Logic 1)</td></tr><tr><td>0V</td><td>:</td><td>LOW</td><td>(Logic 0)</td></tr></table> LED Indication : LED will ON (glow) for 1 state and will be OFF for 0 state. The trainer should performed following experiments: Study and verification of the Truth Table of 4-to-1 Line Multiplexer Study and verification of the Truth Table of 1-to-4 Line De Multiplexer <u>Encoder and Decoder</u> The trainer should have following features: A complete system to study the Encoder & Decoder Easy illustration of Encoder and Decoder LEDs for visual indication of inputs and outputs status SPDT switches for logic selection Different test points Manual with theoretical and practical details The trainer should have following Technical Specifications: <table><tr><td>Input</td><td>:</td><td>+5V DC</td><td></td></tr><tr><td>Logic levels</td><td>:</td><td>+5V</td><td>HIGH (Logic 1)</td></tr><tr><td>0V</td><td>:</td><td>LOW</td><td>(Logic 0)</td></tr></table> LED Indication : LED will be ON (glow) for 1 state and will be OFF	Size of Breadboard	:	Regular	DC Supply	:	+5 V/1 A +12V/1A	Clock Frequency	:	1 Hz, 100 Hz, 1 KHz, 100 KHz	Amplitude	:	3.3 V (TTL)	Duty cycle	:	50 %	Graphical LCD	:	128 X 64 dots	Pulser Switches	:	2 Nos.	Data switches	:	8 Nos. (Toggle switches for both TTL modes)	LED display	:	8 Nos. (TTL)	Seven Segment Display	:	3 Nos.	Power Supply	:	100V - 240V AC, 50Hz	Online Product Tutorial	:	Should be provided	Input	:	+5V DC		Logic levels	:	+5V	HIGH (Logic 1)	0V	:	LOW	(Logic 0)	Input	:	+5V DC		Logic levels	:	+5V	HIGH (Logic 1)	0V	:	LOW	(Logic 0)		
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	for state The trainer should performed following experiments : Study and verification of the Truth Table of 8-to-3 Line Encoder. Study and verification of the Truth Table of 3-to-8 Line Decoder. Counters Trainer DC Power Supply : +5V DC Logic levels +5V : High (Logic 1) 0V : Low (Logic 0) LED Indication: LED will be ON for logic high or '1' state and will be OFF for logic low or '0' state Dimensions (mm) : W 260 x D 355 x H125 4 bit synchronous binary up Counter 4 bit asynchronous binary up/down Counter Verification of operation of IC 74LS190 as a modulo-N programmable Counter Shift Registers Trainer DC Power Supply : +5V Logic levels +5 V : High (Logic 1) 0 V : Low (Logic 0) LED Indication : LED will be ON for logic high or '1' state and will be OFF for logic low or '0' state Dimensions (mm) : 260 W x 355 D x 125 H Study of 3-bit and 4-bit serial in serial out shift register (using D Flip-Flops) • Study of 3-bit and 4-bit serial in parallel out shift register Study of 3-bit and 4-bit parallel in serial out shift register Study of 3-bit and 4-bit parallel in parallel out shift register (using D Flip-Flops) (using D Flip-Flops) (using D Flip-Flops) Design of Code converters Design of 7 segment display using LED and bread board With Training, Learning, Operating, Instrument Control and Simulation Software having topics Digital number system Boolean Algebra & Logic Circuits Digital Logic Gates Simplification of Boolean Functions Digital Combinational Logic Combinational Arithmetic Circuits Sequential Circuits Digital Logic Families Basic digital electronics Simulation software single user with hardware lock should be provided which should assist students for topics like de morgan's law, basic gates/and/or/not, derived gate nand/nor/Xor, derived X or gate, Binary addition and subtraction (half and full) multiplexer and demultiplexer, decimal to bcd encoder, decimal to excess three encoder, decimal to gray encoder, BCD to DECIMAL DECODER, SEVEN SEGMENT DECODER, up counter, down counter, serial in parallel out shift resistor,		
Note: All the accessories offered should be of same (instrument) OEM make only.			

I have also enclosed all relevant documents in support of my claims, (as above) in the following pages.

Signature of Tenderer

Name: _____

Designation: _____

Organization Name: _____

Contact No.: _____

ANNEXURE-IV

<< **Organization Letter Head** >> **DECLARATION SHEET**

We, _____ hereby certify that all the information and data furnished by our organization with regard to these tender specifications are true and complete to the best of our knowledge. I have gone through the specifications, conditions and stipulations in details and agree to comply with the requirements and intent of specification.

This is certified that our organization has been authorized (Copy attached) by the OEM to participate in Tender. We further certify that our organization meets all the conditions of eligibility criteria laid down in this tender document. Moreover, OEM has agreed to support on regular basis with technology / product updates and extend support for the warranty.

We, further specifically certify that our organization has not been Black Listed/De Listed or put to any Holiday by any Institutional Agency/ Govt. Department/ Public Sector Undertaking in the last three years.

NAME & ADDRESS OF THE Vendor/ Manufacturer / Agent	
Phone	
Fax	
E-mail	
Contact Person Name	
Mobile Number	
TIN Number	
PAN Number	
(In case of on-line payment of Tender Fees)	
UTR No. (For Tender Fee)	
(In case of on-line payment of EMD)	
UTR No. (For EMD)	

(Signature of the Tenderer)

Name:

Seal of the Company

ANNEXURE-V

LIST OF GOVT. ORGANIZATION/DEPARTMENT.

List of Government Organizations for whom the Tenderer or their OEM/Manufacture has undertaken such work during last three years (must be supported with work orders)		
Name of the organization	Name of Contact Person	Contact No.

Name of application specialist / Service Engineer who have the technical competency to handle and support the quoted product during the warranty period.		
Name of the organization	Name of Contact Person	Contact No.

Signature of Tenderer

Name: _____

Designation: _____

Organization Name: _____

Contact No.: _____

ANNEXURE- VI

FORMAT FOR PERFORMANCE BANK GUARANTEE

(To be typed on Non-judicial stamp paper of the value of Indian Rupees of One Hundred) (TO BE ESTABLISHED THROUGH ANY OF THE NATIONAL BANKS (WHETHER SITUATED AT GURUGRAM OR OUTSTATION) WITH A CLAUSE TO ENFORCE THE SAME ON THEIR LOCAL BRANCH AT GURUGRAM OR ANY SCHEDULED BANK (OTHER THAN NATIONALISED BANK) SITUATED AT GURUGRAM. BONDS ISSUED BY CO-OPERATIVE BANKS ARE NOT ACCEPTED.)

To,
The Registrar,
Shri Vishwakarma Skill University,
Gurugram
India

LETTER OF GUARANTEE

WHEREAS Shri Vishwakarma Skill University, Gurugram (Buyer) have invited Tenders vide Tender

No.....dt..... for
purchase of and whereas the said tender document requires
that any eligible successful tenderer (seller) wishing to supply the equipment /machinery etc. in
response thereto shall establish an irrevocable Performance Guarantee Bond in favour of
“**Haryana Vishwakarma Skill University**” in the form of Bank Guarantee for Rs
.....

and valid till **three years** from the date of issue of Performance Bank Guarantee may be
submit- ted within 21 (Twenty-One) days from the date of acceptance as a successful tenderer.

NOW THIS BANK HEREBY GUARANTEES that in the event of the said tenderer
(seller) failing to abide by any of the conditions referred in tender document / purchase order /
performance of the equipment / machinery, etc. this bank shall pay to Shri Vishwakarma Skill
University on demand and without protest or demur Rs (Ru-
pees.....).

This bank further agrees that the decision of SVSU, Gurugram (Buyer) as to whether the said
Tenderer (Seller) has committed a breach of any of the conditions referred in tender document /
purchase order shall be final and binding.

We, (name of the bank & branch) hereby further agree that the guarantee
herein contained shall not be affected by any change in the constitution of the Tenderer (Seller)
and/ or Shri Vishwakarma Skill University, Gurugram (Buyer).

Notwithstanding anything contained herein:

1. Our liability under this Bank Guarantee shall not exceed Rs. (Indian Rupees only).
2. This Bank Guarantee shall be valid up to (date) and
3. We are liable to pay the guaranteed amount or any part thereof under this bank guarantee
only and only if Institute serve upon us a written claim or demand on or before(date).

This Bank further agrees that the claims if any, against this Bank Guarantee shall be enforceable at our branch office at situated at (Address of local branch).

Yours truly,

Signature and seal of the guarantor:

Name of Bank:

Address:

Date:

Instruction to Bank: Bank should note that on expiry of Guarantee Period, the Original Guarantee will not be returned to the Bank. Bank is requested to take appropriate necessary action on or after expiry of bond period.

ANNEXURE-VII

MANDATE FORM FOR ELECTRONIC FUND TRANSFER/RTGS TRANSFER

Date: / /

The Registrar

**Shri Vishwakarma Skill University,
Gurugram**

Sub: Authorization for release of payment / dues from Haryana Vishwakarma Skill University, through Electronic Fund Transfer/RTGS Transfer.

1. Name of the Party/Firm/Company/Institute:

2. Address of the Party:

City _____

Pin Code _____

E-Mail ID _____

Mob No: _____

Permanent Account Number _____

3. Particulars of Bank

Bank Name		Branch Name	
Branch Place		Branch City	
PIN Code		Branch Code	
MICR No			
(9 Digit number appearing on the MICR Bank of the Cheque supplied by the Bank, Please attach a Xerox copy of a cheque of your bank for ensuring accuracy of the bank name , branch name and code number)			
IFS Code:(11 digit alphanumeric code)			
Account Type	Savings	Current	Cash Credit
Account Number:			

DECLARATION

I hereby declare that the particulars given above are correct and complete. If any transaction delayed and not effected for reasons of incomplete or incorrect information I shall not hold Registrar, Shri Vishwakarma Skill University, responsible. I also undertake to advise any change in the particulars of my account to facilitate updating of records for purpose of credit of amount through NEFT/RTGS Transfer.

Place: _____

Date: _____

Signature & Seal of the Authorized Signatory of the Party

Certified that particulars furnished above are correct as per our records

Bankers Stamp:

Date: _____

Signature of the Authorized Official from the Bank

N.B: Please fill in the information in CAPITAL LETTERS, computer typed; please TICK wherever it is applicable.

ANNEXURE VIII

MANUFACTURERS' AUTHORIZATION FORM

[The Tenderer shall require the Manufacturer to fill in this Form in accordance with the instructions indicated. This letter of authorization should be on the letterhead of the Manufacturer and should be signed by a person with the proper authority to sign documents that are binding on the Manufacturer.]

Date: *[insert date (as day, month and year) of Bid Submission]*

Tender No.: *[insert number from Invitation for Bids]*

To: *[insert complete name and address of Purchaser]*

WHEREAS

We *[insert complete name of Manufacturer]*, who are official manufacturers of *[insert type of goods manufactured]*, having factories at *[insert full address of Manufacturer's factories]*, do hereby authorize *[insert complete name of Tenderer]* to submit a bid the purpose of which is to provide the following Goods, manufactured by us *[insert name and or brief description of the Goods]*, and to subsequently negotiate and sign the Contract.

We hereby extend our full guarantee and warranty in accordance with Clause 4.8 of the Terms and Conditions, with respect to the Goods offered by the above firm.

Signed: *[insert signature(s) of authorized representative(s) of the Manufacturer]*

Name: *[insert complete name(s) of authorized representative(s) of the Manufacturer]*

Title: *[insert title]*

Duly authorized to sign this Authorization on behalf of: *[insert complete name of Tenderer]*

Dated on _____ day of _____, _____ *[insert date of signing]*

ANNEXURE IX

(to be printed on Supplier's letterhead)

INTEGRITY PACT

General

This pre-bid pre-contract Agreement hereinafter called the Integrity Pact is made between, on one hand, the Vice on..... day of the month of Chancellor, SVSU acting through Registrar, Shri Vishwakarma Skill University hereinafter called the “BUYER” of the first part and M/s..... represented by Shri, Director /Chief Executive Officer/ General Manager hereinafter called the “TENDERER/Seller” of the second part.

WHEREAS the BUYER proposes to procure (Name of the Stores/Equipment/Item) and the TENDERER/Seller is willing to offer/has offered the stores and WHEREAS the TENDERER is a private company/public company/Government undertaking/partnership/registered export agency, constituted in accordance with the relevant law in the matter and the BUYER is a University of the Government of Haryana.

NOW, THEREFORE, to avoid all forms of corruption by following a system that is fair, transparent and free from any influence/prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to enabling the BUYER to obtain the desired said stores / equipment at a competitive price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement, and Enabling Tenderer to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the BUYER will commit to prevent corruption, in any form, by its officials by following transparent procedures.

The parties hereto hereby agree to enter into this Integrity Pact and agree as follows:

1. Commitments of the BUYER:

- 1.1 The BUYER undertakes that no official of the BUYER, connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the TENDERER, either for themselves or for any person, organization or third party related to the contract in exchange for an advantage in the bid-ding process, bid evaluation, contracting or implementation process related to the Contract.

- 1.2 The BUYER will, during the pre-contract stage, treat all Tenderer alike, and will provide to all Tenderer the same information and will not provide any such information to any particular TENDERER which could afford an advantage to that particular TENDERER in comparison to other Tenderer.
- 1.3 All the officials of the Buyer will report to the appropriate Government office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.
- 1.4 In case any such preceding misconduct on the part of such official (s) is reported by the TENDERER to the BUYER, with full and verifiable facts and the same is prima facie found to be correct by the BUYER, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings may be initiated by the BUYER and such a person shall be debarred from further dealings related to the contract process. In such a case while an enquiry is being conducted by the BUYER the proceedings under the contract would not be stalled.

2. Commitments of TENDERER:

The TENDERER commits itself to take all measures necessary to prevent corrupt practices, un-fair means and illegal activities during any stage of its bid or during any pre-contract or post contract stage in order to secure the contract or in furtherance to secure it and in particular commit itself to the following:

- 2.1 The TENDERER will not offer, directly or through intermediaries, any bribe, consideration, gift, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the BUYER, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the Contract.
- 2.2 The TENDERER further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the BUYER or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the Contract or any other Contract with the Government for showing or forbearing to show favour or disfavour to any person in relation to the Contract or any other Contract with the Government.
- 2.3 Tenderer shall disclose the name and address of agents and representatives and Indian Tenderer shall disclose their foreign principals or associates.
- 2.4 Tenderer shall disclose the payments to be made by them to agents / brokers or any other intermediary, in connection with this bid/contract.
- 2.5 The TENDERER further confirms and declares to the BUYER that the TENDERER is the original manufacturer/ integrator/ authorized government sponsored export entity of the defense stores and has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the BUYER, or any of its

functionaries, whether officially or unofficially to the award of the contract to the TENDERER, nor has any amount been paid, promised or intended to be paid to any such

individual, firm or company in respect of any such intercession, facilitation or recommendation.

- 2.6 The TENDERER, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payments he has made, is committed to or intends to make to officials of the BUYER or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.
- 2.7 The TENDERER will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.
- 2.8 The TENDERER will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.
- 2.9 The TENDERER shall not use improperly, for purposes of competition or personal gain, or pass on to others, any information provided by the BUYER as part of the business relationship, regarding plans, technical proposals and business details, including information contained in any electronic data carrier. The TENDERER also undertakes to exercise due and adequate care lest any such information is divulged.
- 2.10 The TENDERER commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.
- 2.11 The TENDERER shall not instigate or cause to instigate any third person to commit any of the actions mentioned above.
- 2.12 If the TENDERER or any employee of the TENDERER or any person acting on behalf of the TENDERER, either directly or indirectly, is a relative of any of the officers of the BUYER, or alternatively, if any relative of an officer of the BUYER has financial interest/stake in the TENDERER's firm, the same shall be disclosed by the TENDERER at the time of filing of tender. The term relative for this purpose would be as defined in Section 6 of the Companies Act 1956.
- 2.13 The TENDERER shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the BUYER.

3. Previous Transgression

3.1 The TENDERER declares that no previous transgression occurred in the last three years immediately before signing of this Integrity Pact, with any other company in any country in respect of any corrupt practices envisaged hereunder or with any Public Sector Enterprise in India or any Government Department in India that could justify TENDERER's exclusion from the tender process

- 3.2 The TENDERER agrees that if it makes incorrect statement on this subject, TENDERER can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

4. Earnest Money Deposit

- 4.1 While submitting bid, the TENDERER shall deposit an amount mentioned in tender document as Earnest Money.
- 4.2 No interest shall be payable by the BUYER to the TENDERER on Earnest Money for the period of its currency.
- 4.3 In case of successful TENDERER, EMD will be returned within 30 days from the date of submission of Performance Bank Guarantee.

5. SECURITY DEPOSIT /PERFORMANCE GUARANTEE:

- 5.1 Performance Bank Guarantee is mandatory.
- 5.2 Successful tenderer/ tenderer should submit performance guarantee as prescribed above to be received in the office Registrar, Stores & Purchase Section on or before 30 days from the date of issue of order acknowledgement. The performance bank guarantee to be furnished in the form of Bank Guarantee as per Annexure-VI of the tender documents, for an amount covering 10% of the purchase order value.
- 5.3 The Performance Bank Guarantee should be established in favour of **Haryana Vishwakarma Skill University,** ” through any Bank situated at Gurugram or outstation with a clause to enforced the same on their local branch at Gurugram. Performance Bank Guarantee shall be for the due and faithfully performance of the contract and shall remain binding, notwithstanding such variations, alterations for extensions of time as may be made, given, conceded or agreed to between the successful tenderer and the purchaser under the terms and conditions of acceptance to tender.
- 5.4 The successful tenderer is entirely responsible for due performance of the contract in all respects according to the speed, intent and meaning of the terms and conditions and specification and all other documents referred to in the acceptance of tender.
- 5.5 The performance bank guarantee shall be kept valid during the period of contract and shall continue to be enforceable for a period of two years from the date of order acknowledgement.

6. Sanctions for Violations

- 6.1 Any breach of the aforesaid provisions by the TENDERER or any one employed by it or acting on its behalf (whether with or without the knowledge of the TENDERER)

shall entitle the BUYER to take all or any one of the following actions, wherever required:

- 6.1.1 To immediately call off the pre-contract negotiations without assigning any reason or giving any compensation to the TENDERER. However, the proceedings with the other TENDERER(s) would continue.
 - 6.1.2 The Earnest Money Deposit (in pre-contract stage) and/or Security Deposit/Performance Bank Guarantee (after the contract is signed) shall stand forfeited either fully or partially, as decided by the BUYER and the BUYER shall not be required to assign any reason therefore.
 - 6.1.3 To immediately cancel the contract, if already signed without giving any compensation to the TENDERER.
 - 6.1.4 To recover all sums already paid by the BUYER, and in case of an Indian TENDERER with interest thereon at 2% higher than the prevailing Prime Lending Rate of State Bank of India, while in case of a TENDERER from a country other than India with interest thereon at 2% higher than the LIBOR. If any outstanding payment is due to the TENDERER from the BUYER in connection with any other contract for any other stores, such outstanding payment could also be utilized to recover the aforesaid sum and interest.
 - 6.1.5 To encash the advance bank guarantee and performance guarantee/warranty bond, if furnished by the TENDERER, in order to recover the payments, already made by the BUYER, along with interest.
 - 6.1.6 To cancel all or any other contracts with the TENDERER. The TENDERER shall be liable to pay compensation for any loss or damage to the BUYER resulting from such cancellation/rescission and the BUYER shall be entitled to deduct the amount so payable from the money(s) due to the TENDERER.
 - 6.1.7 To debar the TENDERER from participating in future bidding processes of the Government for a minimum period of two years, which may be further extended at the discretion of the BUYER.
 - 6.1.8 To recover all sums paid in violation of this pact by the TENDERER(s) to any middleman or agent or broker with a view to securing the contract.
 - 6.1.9 In cases where irrevocable Letters of Credit have been received in respect of any contract signed by the BUYER with the TENDERER, the same shall not be opened.
 - 6.1.10 Forfeiture of Performance Bank Guarantee in case of a decision by the BUYER to forfeit the same without assigning any reason for imposing sanction for violation of this Pact.
- 6.2 The BUYER will be entitled to take all or any of the actions mentioned at para 6.1.1 to 6.1.10 of this Pact also on the Commission by the TENDERER or any one employed by it or acting on its behalf (whether with or without the knowledge of the TENDERER), of an offence as defined in Chapter IX of the Indian Penal code, 1860 or Prevention of Corruption Act, 1988 or any other statute enacted for prevention of corruption.
- 6.3 The decision of the BUYER to the effect that a breach of the provisions of this pact has been committed by the TENDERER shall be final and conclusive on the TENDERER. However, the TENDERER can approach the independent monitor(s) appointed for the purposes of this pact.

7. Fall Clause

The TENDERER undertakes that it has not supplied/is not supplying similar product/systems or sub-systems at a price lower than that offered in the present bid in respect of any other Ministry/Department PSU and if it is found at any stage that similar product/system or subsystem was supplied by the TENDERER to any other Ministry/Department of the Government or PSU at a lower price, then that very price, with due allowance for elapsed time, will be applicable to the present case and the difference in the cost would be refunded by the TENDERER to the BUYER, if the contract has already been concluded.

8. Independent monitors

- 8.1 The BUYER may appointed Independent Monitors (hereinafter referred to as Monitors) for this pact.
- 8.2 The task of the Monitor shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this pact.
- 8.3 The Monitor shall not be subject to instructions by the representatives of the parties and performs their functions neutrally and independently.
- 8.4 Both the parties accept that the Monitor have the right to access all the documents relating to the project/procurement, including minutes of the meetings.
- 8.5 As soon as the Monitor notices, or believes to notice, a violation of this pact, he will so inform the Authority designated by the BUYER.
- 8.6 The TENDERER(s) accepts that the Monitor has the right to access without restriction to all project documentation of the BUYER including that provided by the TENDERER. The TENDERER will also grant the Monitor, upon his request and demonstration of a valid interest, unrestricted and unconditional access to his project documentation. The same is applicable to subcontractors. The Monitor shall be under contractual obligation to treat the information and documents of the TENDERER/Subcontractor(s) with confidentiality.
- 8.7 The BUYER will provide to the Monitor sufficient information about all meetings among the parties related to the project provided such meetings could have an impact on the contractual relations between the parties. The parties will offer to the Monitor the option to participate in such meetings.
- 8.8 The Monitor will submit a written report to the designated Authority of BUYER/ Secretary in the Department/within 08 to 10 weeks from the date of reference or intimation to him by the BUYER / TENDERER and, should the occasion arise, submit proposals for correcting problematic situations.

9. Facilitation of Investigation

In case of any allegation of violation of any provisions of this pact or payment of commission, the BUYER or its agencies shall be entitled to examine all the documents including the Books of Accounts of the TENDERER and the TENDERER shall provide necessary information & documents in English and shall extend all possible help for the purpose of such examination.

10. Law and Place of Jurisdiction

This Pact is subject to Indian Law. The place of performance and Jurisdiction is the Seat of the BUYER.

11. Other Legal Actions

The actions stipulated in this Integrity Pact are without prejudice to any other legal action that may follow in accordance with the provisions of the extant law in force relating to any civil or criminal proceedings.

12. Validity

12.1 The validity of this Integrity Pact shall be from date of its signing and extend upto 3 years or the complete execution of the contract to the satisfaction of both the BUYER and the TENDERER/ Seller, including warranty period, whichever is later. In case TENDERER is unsuccessful, this Integrity Pact shall expire after six months from the date of the signing of the contract.

12.2 Should one or several provisions of this pact turn out to be invalid, the remainder of this pact remains valid. In this case, the parties will strive to come to an agreement to their original intentions.

13. The parties hereby sign this Integrity Pact.

BUYER

TENDERER

SVSU

Signature with seal

Date & Place:

Date & Place:

Witness

Witness

1. _____

1. _____

(Indenter)

Annexure -X

Training Requirement

Product Description	Electrical and Electronics workbench
No of Attendees	Faculty of University
No. of Days	1-2 Days on each bench
Type of Training	Operational Training / Maintenance Training

BID SUBMISSION**Offline Bid Submission:**

The Offline bids (complete in all respect) must be sealed in **two** Envelops as explained below: -

Envelope – 1

Sl. No.	Documents	Content
		Technical supporting documents in support of all claims made at Annexure- I
		Terms and Conditions Annexure – II – Signed on each page with seal
		Compliance Sheet Annexure - III
		Organization Declaration Sheet as per Annexure - IV
		List of organizations/ clients where the same products have been supplied
		(in last two years) along with their contact number(s). (Annexure-V)
		Format For Performance Bank Guarantee (Annexure VI)
	Technical Bid	Mandate Form for Electronic Fund Transfer/RTGS Transfer (Annexure VII)
		Manufacturers' Authorization Form (Annexure-VIII)
		Integrity Pact (Annexure IX)
		Training Requirement (Annexure –X)
		Bid Submission List (Annexure –XI)

Envelope – 2

Sl. No.	TYPES	Content
1.	Financial Bid	Price bid

PRICE BID
(For Indigenous items)

Reference/Tender No.: -

Due Date: -

Sl. No	Description of item & specification with Make & Model No.	Qty In Units	Unit Price	Dis-count %	Excise/ Custom Duty %	GST %	Other charges if any please specify details	Total Price
1.	Total workbenches as technical specification in Annexure I with 3 years warranty	6						

1. Delivery Mode: - Delivery at University, at site only.
2. Total price bids in the above column should be inclusive of all taxes and levies transport, loading, unloading etc.
3. Delivery Period:days
4. Validity of the bid 120 days from the date of submission of quotation/tender.
5. Terms of payment: Payment within 30 days from the date submission of bill Acceptance Certificate to concerned department/section/S&P section.

Signature.....
 Name.....
 Business Address.....

 Affix Rubber Stamp.....
 Place:
 Date:

Note: - Price Bid should be submitted in given format only. For additional information/extra items above format may be typed and used.