

# University College of Engineering and Technology,

Karni Industrial Area, Pugal Road, Bikaner-334004

## INVITATION LETTER

Package Code: TEQIP-III/2019/RJ/gceb/111

Current Date: 05-Oct-2019

Package Name: Power Electronics Lab

Method: Shopping Goods

To,

---

---

---

**Sub: INVITATION LETTER FOR Power Electronics Lab**

Dear Sir,

1. You are invited to submit your most competitive quotation for the following goods with item wise detailed specifications given at Annexure I,

Sr. No	Item Name	Quantity	Place of Delivery	Installation Requirement (if any)
1	Three Phase Semi controlled Phase Control Rectifier	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
2	Single Phase PWM AC power controller Test setup	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
3	Three Phase Fully controlled AC Power Controller	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
4	Three Phase Fully controlled Phase Control Rectifier	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering

				Department , UCET, Bikaner
5	Three Phase PWM AC power controller setup	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
6	Single Phase Fully controlled AC power controller	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
7	12-Pulse Controlled Phase Control Rectifier	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
8	Single Phase Single Pulse PWM Inverter Test setup	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
9	Single Phase Multi Pulse PWM Inverter Test setup	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
10	Three Phase Fully controlled Adjustable Nonlinear Loading System	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
11	Three Phase 4 Leg Voltage Source Inverter	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
12	Three Phase 4 Leg IGBT converter with separate DC Bus Voltage for DC-DC converters	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
13	Adjustable Regulated DC	1	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering

	Voltage High Power DC supply			Department , UCET, Bikaner
14	Power analyzer	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
15	Current probes	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
16	Inductive load bank	1	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
17	Three Phase induction motor coupled with DC machine	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
18	Single phase induction motor coupled with DC machine	2	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner
19	Inductors 0-25 mH, 25 A	4	Electrical Engineering Department , UCET, Bikaner	SITC at Electrical Engineering Department , UCET, Bikaner

2. Government of India has received a credit from the International Development Association (IDA) towards the cost of the **Technical Education Quality Improvement Programme [TEQIP]-Phase III** Project and intends to apply part of the proceeds of this credit to eligible payments under the contract for which this invitation for quotations is issued.

**3. Quotation**

- 3.1 The contract shall be for the full quantity as described above.
- 3.2 Corrections, if any, shall be made by crossing out, initialling, dating and re writing.
- 3.3 All duties and other levies payable by the supplier under the contract shall be included in the unit Price.
- 3.4 Applicable taxes shall be quoted separately for all items.

- 3.5 The prices quoted by the bidder shall be fixed for the duration of the contract and shall not be subject to adjustment on any account.
- 3.6 The Prices should be quoted in Indian Rupees only.
4. Each bidder shall submit only one quotation.
5. Quotation shall remain valid for a period not less than **55** days after the last date of quotation submission.
6. Evaluation of Quotations: The Purchaser will evaluate and compare the quotations determined to be Substantially responsive i.e. which
- 6.1 are properly signed; and
- 6.2 Confirm to the terms and conditions, and specifications.
7. The Quotations would be evaluated for all items together.
8. Award of contract The Purchaser will award the contract to the bidder whose quotation has been determined to be substantially responsive and who has offered the lowest evaluated quotation price.
- 8.1 Notwithstanding the above, the Purchaser reserves the right to accept or reject any quotations and to cancel the bidding process and reject all quotations at any time prior to the award of Contract.
- 8.2 *The bidder whose bid is accepted will be notified of the award of contract by the Purchaser prior to expiration of the quotation validity period. The terms of the accepted offer shall be Incorporated in the purchase order.*
9. Payment shall be made in Indian Rupees as follows:

<b>Payment Description</b>	<b>Expected Delivery Period (in Days)</b>	<b>Payment Percentage</b>
Satisfactory Acceptance	30	100

10. Liquidated Damages will be applied as per the below:  
Liquidated Damages Per Day Min %: 0.01

Liquidated Damages Max %: 10

11. All supplied items are under warranty of **24** months from the date of successful acceptance of items and AMC/Others is .
12. You are requested to provide your offer latest by **14:00** hours on **19-Oct-2019**.
13. Detailed specifications of the items are at Annexure I.
14. Training Clause (if any) **Training Required**
15. Testing/Installation Clause (if any) **SITC at Electrical Engineering Department of UCET, Bikaner**
16. Performance Security shall be applicable: **5%**
17. Information brochures/ Product catalogue, if any must be accompanied with the quotation clearly indicating the model quoted for.
18. Sealed quotation to be submitted/ delivered at the address mentioned below, **University College of Engineering and Technology, Karni Industrial Area, Pugal Road, Bikaner-334004**
19. We look forward to receiving your quotation and thank you for your interest in this project.

Nodal Officer Procurement  
University College of Engineering & Technology  
Bikaner

## Annexure I

Sr. No	Item Name	Specifications
1	Three Phase Semi controlled Phase Control Rectifier	<p>Three Phase Semi controlled Phase Control Rectifier Three Phase Semi controlled Phase Controlled Rectifier should be capable of operating in three phase mode. The power electronic converter of the system should be capable to convert the 3-phase AC Power in to Controllable/Adjustable DC power in semi controlled manner.It should also control the flow of DC power from source to the dynamic load/resistive load/inductive load in steady state as well as in transient situations. The power electronic switches should operate on fundamental frequency and power flow should be controlled using phase control technique. Output Current Rating: 100 Amp RMS (AC) or higher. Input Voltage (fixed at any value between): 0-415 V RMS (AC) Adjustable Output Voltage Range (adjustable at any value which is less than the RMS value of the input voltage): 250-415 VDC (Firing Angle 0 to 180 degree). Switch Type: SCR.L-C Filter should be incorporated for harmonic reduction analysis in output current of supply.The Three Phase Semi controlled Phase Control Rectifier should have soft start feature.Three Phase Semi controlled Phase Control Rectifier must be capable of driving Dynamic load, R-L, Resistive &amp; Battery Charging Load.Access points for all input and output variable must be available on the front panel to register the transient changes in the system during the sudden load changes and dynamic situations.The enclosure of test setup should be fully transparent with metal base for better academic value addition and for better understanding of the students about the system.Output voltage control settings knobs must be available on the front panel of the Three Phase Semi controlled Phase Control Rectifier system.Proper isolation between control and power circuit must be provided in the system.Proper load and source side protection must be provided in the system.The meters for displaying real time experimental values of the output voltage, input voltage &amp; firing angle (delay angle) must be provided on the panel board.</p>
2	Single Phase PWM AC power controller Test setup	<p>Single Phase PWM AC power controller test setup, capable of operating in adjustable switching frequency from 1 kHz to 15 kHz using PWM technique with adjustable duty Ratio of 0.1 to 0.9 and the controller should be capable to feed an adjustable AC power to 1 phase AC loads. The flow of power should be controlled</p>

		<p>using the pulse width modulation control technique. Output Current Rating: 35 Amp RMS (AC) Input Voltage (fixed at any value between) : 0-230 V RMS (AC) Adjustable Output Voltage Range (adjustable at any designed value which is less than the input voltage): 0-230 V DC Switch Type : Fully-Controlled type IGBT Switching All power electronic switches (IGBTs) of the power converter of the Three Phase PWM AC power controller test setup should operate up to 15 kHz. Single Phase PWM AC power controller test setup should be capable of driving Dynamic, R-L &amp; Resistive Loads. Single Phase PWM AC power controller test setup must have appropriate snubber protection of Switching Devices. The output voltage control knob must be available on the front panel of the test setup. Proper isolation between control and power circuit must be provided in the single Phase PWM AC power controller test setup. The real time experimental values of the output voltage, input voltage must be displayed on the panel board using suitable meters.</p>
3	Three Phase Fully controlled AC Power Controller	<p>Three Phase Fully controlled AC power Controller should be capable of operating in three phase mode. The power electronic converter of the system should be capable to control the flow of 3 phase AC power from source to the 3 phase star connected with floating Neutral/ star connected with Neutral in fully controlled manner connected/Delta Connected dynamic/resistive loads. The power electronic switches should operate on fundamental frequency and power flow should be controlled using phase control technique. Output Current Rating: 100 Amp/phase RMS (AC). Input Voltage (fixed at any value between): 250-415 V RMS (AC) for 3 phase mode of operation Adjustable Output Voltage Range (adjustable at any value which is less than the input voltage): 250-415 V RMS (AC) for 3 phase mode of operation. Switch Type: SCR. L-C Filter should be incorporated for harmonic reduction analysis in output current of supply. The Three Phase Fully controlled AC power Controller should have soft start feature. Three Phase Fully controlled AC power Controller must be capable of driving Dynamic, R-L , Resistive &amp; Battery charging loads. Output voltage control settings must be available on the front panel of the Three Phase Fully controlled AC power Controller system. Proper isolation between control and power circuit must be provided in the system. The real time experimental values of the output voltage, input voltage &amp; firing angle (delay angle) must be displayed on the panel board using suitable meters.</p>
4		

	<p>Three Phase Fully controlled Phase Control Rectifier</p>	<p>Single Phase Fully controlled Phase Control Rectifier should be capable of operating in fundamental switching frequency using phase control technique. The power electronic converter of the system should be capable to convert the 1 phase AC Power in to Controllable DC output power &amp; voltage fully controlled manner.It should also control the flow of DC power from AC source to the DC dynamic load/resistive load/inductive load systems in steady state and transient situations. The power electronic switches should operate on fundamental frequency and power flow should be controlled using phase control Technique.Output Current Rating: 100 Amp/phase RMS (AC).Input Voltage (fixed at any value between): 0-230 V RMS (AC) (1-phase)Adjustable Output Voltage Range (adjustable at any designed value which is less than the RMS value of the input voltage): 0-230V DC. Switch Type: SCR. L-C Filter should be incorporated.The Single Phase fully controlled Phase Control Rectifier should have soft start feature.Single Phase fully controlled Phase Control Rectifier must be capable of driving Dynamic load, R-L, Resistive Load &amp; Battery Charging loads.Output voltage control knob must be available on the front panel of the Single Phase fully controlled Phase Control Rectifier system. Proper isolation between control and power circuit must be provided in the system.The real time experimental values of the output voltage, input voltage &amp; firing angle (delay angle) must be displayed on the panel board using suitable meters.</p>
<p>5</p>	<p>Three Phase PWM AC power controller setup</p>	<p>Three Phase PWM AC power controller test setup, capable of operating three phase mode of operations and the controller should be capable to control the flow of AC power from 3 phase source to 3 phase star connected with floating Neutral/ star connected with Neutral connected/Delta Connected dynamic/resistive loads using PWM techniques. The test system should also be capable of feeding to single phase loads. The flow of power should be controlled using the pulse width modulation control technique.Output Current Rating: 35 Amp/phase RMS (AC).Input Voltage (fixed at any value between): 200-415 V RMS (AC).Adjustable Output Voltage Range (adjustable at any designed value which is less than the input voltage): 200-415 V RMS (AC).Switch Type: Fully-Controlled type IGBT Switching.L-C Filter should be incorporated.All power electronic switches (IGBTs) of the power converter of the Three Phase PWM AC power controller test setup should operate up to 10 kHz.Three Phase PWM AC power controller test setup must be capable of driving Dynamic, R-L, and Resistive Load.Three Phase PWM AC power</p>



		controller test setup must have appropriate snubber protection of Switching Devices. Output voltage control knob must be available on the front panel of the test setup. Proper isolation between control and power circuit must be provided in the Three Phase PWM AC power controller test setup.
6	Single Phase Fully controlled AC power controller	Single Phase Fully controlled AC power Controller should be capable of operating in fundamental switching frequency using phase control technique. . The power electronic converter of the system should be capable to control the flow of AC power from source to the 1 phase dynamic load/resistive load/inductive load systems in steady state and transient situations. The power electronic switches should operate on fundamental frequency and power flow should be controlled using phase control technique. Output Current Rating: 100 Amps RMS (AC). Input Voltage (fixed at any value between) : 0-230V V RMS (AC) Adjustable Output Voltage Range (adjustable at any value which is less than the input voltage): 0-230V V RMS (AC). Switch Type: SCR. L-C Filter should be incorporated. The Single Phase Fully controlled AC power Controller should have soft start feature. Single Phase fully controlled AC power Controller must be capable of driving Dynamic, R-L, and Resistive Load. Input and output voltage control knobs must be available on the front panel of the Single Phase fully controlled AC power Controller system. Proper isolation between control and power circuit must be provided in the system. The real time experimental values of the output voltage, input voltage & firing angle (delay angle) must be displayed on the panel board using suitable meters.
7	12-Pulse Controlled Phase Control Rectifier	12 Pulses Controlled Rectifier consist of a transformer required to convert three phase AC supply into six phase AC power supply with required 30 degree phase shifting along with required control circuitry. The transformer should be consists of a three phase delta connected primary winding with 415V (Line to Line) and two secondary windings one in star connection another one in delta connection both with 30V (Line to Line) output in each secondary winding. The power rating of the transformer should be more than 5 kVA capacity. The power electronic converter of the system should be capable to convert the 3 phase AC power into 6 phase AC power than 6 phase AC Power in to 12 pulse controllable DC power/voltage in semi controlled manner. It should also control the flow of DC power from source to the dynamic load/resistive load/inductive load systems in steady state and transient situations. The

		<p>power electronic switches should operate on fundamental frequency and power flow should be controlled using phase control technique. Power converter Output Current Rating: 100 Amp RMS (AC)/phase, Input Voltage (fixed at any value between) : 0-415 V RMS (AC) Adjustable Output Voltage Range (adjustable at any value which is less than the RMS value of the input voltage): 0-60 VDC (12 pulse). Switch Type : SCR. L-C Filter should be incorporated. The 12 Pulses Controlled Rectifier should have soft start feature. 12 Pulses Controlled Rectifier must be capable of driving Dynamic load, R-L &amp; Resistive Load. Output voltage control settings must be available on the front panel of the 12 Pulses Controlled Rectifier system. Proper isolation between control and power circuit must be provided in the system. The real time experimental values of the output voltage, input voltage &amp; firing angle (delay angle) must be displayed on the panel board using suitable meters.</p>
8	Single Phase Single Pulse PWM Inverter Test setup	<p>Single Phase Single Pulse PWM Inverter Test setup, capable of converting AC voltage in to adjustable DC voltage for DC bus than convert this DC Voltage into Single Pulse PWM AC voltage using adjustable single pulse PWM technique. The system should be capable of operating in adjustable switching frequency from 45Hz to 200 Hz using PWM technique with adjustable duty Ratio of 0.1 to 0.9 and the controller should be capable to feed an adjustable AC power to 1 phase AC loads, The flow of Single Pulse PWM AC power should be controlled using the single pulse width modulation control technique with practical evidence of selective harmonic elimination. Output Current Rating: 50 Amp RMS (AC). Input Voltage (fixed at any value between) to the system : 230 V RMS (AC) DC bus voltage: - Adjustable Between 20V to 230V DC (Range of the variation in DC bus voltage depends on input AC voltage fed to the input side of single phase controlled rectifier). Adjustable Output Voltage Range (adjustable at any value which is less than the input voltage): 20-220 V AC with selective harmonic elimination. Switch Type: Fully-Controlled type IGBT Switching. All power electronic switches (IGBTs) of the power converter of the Single Phase Single Pulse PWM Inverter Test setup should operate up to 10 kHz. Single Phase Single Pulse PWM Inverter Test setup must be capable of different types of single phase Loads. Single Phase Single Pulse PWM Inverter Test setup must have appropriate snubber protection of Switching Devices. Access points should be available for Intermediate signaling points of the control and power circuit of the Single Phase Single Pulse PWM Inverter Test setup. Access points must be available on the front</p>

		<p>panel to register the transient changes in the system during the sudden load changes and dynamic situations. The output voltage control settings knobs must be available on the front panel of the test setup. Proper isolation between control and power circuit must be provided in the Single Phase Single Pulse PWM Inverter Test setup. The real time experimental values of the output voltage, input voltage must be displayed on the panel board using suitable meters.</p>
9	Single Phase Multi Pulse PWM Inverter Test setup	<p>Single Phase Multi-Pulse PWM Inverter Test setup, capable of converting AC voltage in to adjustable DC voltage for DC bus than convert this DC Voltage into Multi-Pulse PWM AC voltage using adjustable Multi-Pulse PWM technique. The system should be capable of operating in adjustable switching frequency from 45Hz to 200 Hz using PWM technique with adjustable duty Ratio of 0.1 to 0.9 and the controller should be capable to feed an adjustable AC power to 1 phase AC loads, The flow of power should be controlled using the Multi-Pulse width modulation control technique. Output Current Rating: 50 Amp RMS (AC). Input Voltage (fixed at any value between) to the system: 230 V RMS (AC). DC bus voltage: - Adjustable Between 20V to 300V DC (Range of the variation in DC bus voltage depends on input AC voltage fed to the input side of single phase controlled rectifier). Adjustable Output Voltage Range (adjustable at any value which is less than the input voltage): 10-220 V AC. Switch Type: Fully-Controlled type IGBT Switching. All power electronic switches (IGBTs) of the power converter of the Single Phase Multi-Pulse PWM Inverter Test setup should operate up to 10 kHz. Single Phase Multi-Pulse PWM Inverter Test setup must be capable of driving different types of Loads. Single Phase Multi-Pulse PWM Inverter Test setup must have appropriate snubber protection of Switching Devices. The output voltage control settings knobs must be available on the front panel of the test setup. Proper isolation between control and power circuit must be provided in the Single Phase Multi-Pulse PWM Inverter Test setup. The real time experimental values of the output voltage, input voltage must be displayed on the panel board using suitable meters.</p>
10	Three Phase Fully controlled Adjustable Nonlinear Loading System	<p>Three Phase Fully controlled Adjustable Nonlinear Loading system with adjustable nonlinearity. The " Three Phase Fully controlled Adjustable Nonlinear Loading system should be capable of drawing 3 phase power from the 3 phase source of any nature (standalone AC generator or utility AC grid) with an adjustable amount of harmonic currents in the system. Three Phase Fully</p>

		<p>controlled Adjustable Nonlinear Loading system should be capable of drawing an adjustable amount of harmonic currents from 3 phase source, with floating and without floating star dynamic load conditions and delta dynamic loading conditions in steady state and transient situations. The power electronic switches should operate on fundamental frequency and power flow should be controlled using phase control technique. Maximum Line Current Rating: 100 Amp RMS (AC) per line, total maximum output power 30kW. Input Voltage (fixed at any value between) : 0-415 V RMS (AC) for 3 phase mode of operation Adjustable Output Voltage Range (adjustable at any value which is less than the input voltage): 0-415 V RMS (AC) for 3 phase mode of operation. Switch Type: SCR. The Three Phase Fully controlled Adjustable Nonlinear Loading system should have soft start feature. Three Phase Fully controlled Adjustable Nonlinear Loading system must have suitable protection System. Input and output voltage control settings knobs must be available on the front panel of the Three Phase Fully controlled AC power Controller system. Proper isolation between control and power circuit must be provided in the system. The real time experimental values of the output voltage, input voltage &amp; firing angle (delay angle) must be displayed on the panel board using suitable meters.</p>
11	Three Phase 4 Leg Voltage Source Inverter	<p>Three Phase 4 Leg Voltage Source Inverter Max. Input DC Voltage: 800V with Common DC Bus Voltage for all four Legs of IGBTs Max. Output AC Voltage: 415 V Max. Output AC Current: 35A or more Max. KVA rating: 25kVA at max. AC voltage and current ratings Max. Switching Frequency : 20 kHz or more Type of cooling (Forced Air cooled / Water cooled / Natural cooled): Forced Air cooled Duty class / Overload: 100% Continuous, 150% for 1 minute or higher Gate Drivers of Semikron make skyper 32A or equivalent The regulated DC Power Supply should be inbuilt in the system for Gate Drivers</p>
12	Three Phase 4 Leg IGBT converter with separate DC Bus Voltage for DC-DC converters	<p>Three Phase 4 Leg IGBT converter with separate DC Bus Voltage for DC-DC converters Max. Input DC Voltage : 800V with separate DC Bus Voltage for each of four Legs of IGBTs Max. Output AC Voltage : 415 V Max. Output AC Current : 35A or higher Max. KVA rating: 25kVA at max. AC voltage and current ratings Max. Switching Frequency : 20 kHz or more Type of cooling (Forced Air cooled / Water cooled / Natural cooled) : Forced Air cooled Duty-class / Overload: 100% Continuous, 150% for 1 minute or higher. Single stack / Parallel stack : Single stack Gate Drivers of Semikron</p>

		make skyper 32A or equivalent The regulated DC Power Supply should be inbuilt in the system for Gate Drivers	
13	Adjustable Regulated DC Voltage High Power DC supply	Adjustable Regulated DC Voltage High Power DC supply should be capable of operating in fundamental switching frequency using phase control technique. The power electronic converter of the system should be capable to convert the 1-phase AC Power in to Adjustable/Controllable & regulated output DC voltage.It should feed the Adjustable/Controllable & regulated output DC voltage to the dynamic load/resistive load/inductive load systems in steady state and transient operating conditions. The power electronic switches should operate on fundamental frequency and power flow should be controlled using phase control technique.Max. Output Current Rating: 100 Amp DC.Input Voltage (fixed at any value between): 230 V RMS (AC).Adjustable/Controllable & regulated output DC voltage Range: 100-230V DC.Switch Type: SCR.L-C Filter should be incorporated for ripple reduction in output side of supply.Adjustable Regulated DC Voltage High Power DC supply should have soft start feature.Output voltage control settings knobs must be available on the front panel of the Adjustable Regulated DC Voltage High Power DC supply system.The real time experimental values of the output voltage, input voltage & output current must be displayed on the panel board using suitable meters.	
14	Power analyzer	Vertical	
		Frequency response - dc coupled Frequency response - ac coupled (If roll off) Rise time, excluding probes, test leads Input impedance Sensitivity Analog bandwidth limiter Display modes Max. Input voltage A and B Max. floating voltage, from any terminal to ground Horizontal Scope modes Ranges (Normal) Sampling rate (for both channels simultaneously)	without probes and test dc to 40 MHz (-3 dB)
		with STL120-IV 1:1 shielded test leads	DC to 12.5 MHz (-3 dB) / dc to 20 MHz (-6 dB)

		with VP41 10:1 Probe without probes and test leads	dc to 40 MHz (-3 dB) <10 Hz (-3 dB)
		with STL120-IV 1:1 shielded test leads	<10 Hz (-3 dB)
		with BB120	1 MΩ//24 pF
		with STL120-IV 1:1 shielded test leads	1 MΩ//230 pF
		with VP41 10:1 Probe 5 MΩ//15.5 pF 5 mV to 200 V/div 10 kHz A, -A, B, -B direct, with test leads, or with VP41 Probe 600 Vrms CAT IV, 750 Vrms maximum voltage.	
		with BB120 600 Vrms 600 Vrms CAT IV, 750 Vrms up to 400Hz Normal, Single, Roll Equivalent sampling 10 ns to 500 ns/div	
		Real time sampling	1 μs to 5 s/div
		Single (real time)	1 μs to 5 s/div
		Roll (real time) Equivalent sampling (repetitive signals)	1s to 60 s/div up to 4 GS/s
		Real time sampling 1 μs to 60 s/div	40 MS/s
		Trigger Screen update	
		Free run, on trigger A, B @ DC to 5 MHz 0.5 divisions or 5 mV	
		@ 40 MHz	
		1.5 divisions	
		@ 60 MHz	
		4 divisions	Positive, negative
		Source Sensitivity A and B Slope Advanced scope functions Display modes	
		Normal	Captures up to 25 ns glitches and displays analog-like persistence waveform.
		Smooth	Suppresses noise from a waveform.
		Glitch off	Does not capture glitches between samples

		<p>Envelope Records and displays the minimum and maximum of waveforms over time.</p> <p>Continuous fully automatic adjustments of amplitude, time base, trigger levels, trigger gap, and hold-off. Manual override by user adjustment of amplitude, time base, or trigger level.</p>	
		<p>Auto set Dual input meter</p> <p>the accuracy of all measurements is within <math>\pm</math> (% of reading + number of counts) from 18 °C to 28 °C. Add 0.1x (specific accuracy) for each °C below 18 °C or above 28 °C. For voltage measurements with 10:1 probe, add probe uncertainty +1 %. More than one waveform period must be visible on the screen.</p> <p>Input A and input B</p> <p>DC voltage (VDC)</p> <p>Ranges 500 mV, 5 V, 50 V, 500 V, 750 V</p> <p>Accuracy <math>\pm</math> (0.5 % +5 counts)</p> <p>Common mode rejection (CMRR) &gt;100 dB @ dc, &gt;60 dB @ 50, 60, or 400 Hz</p> <p>Full scale reading 5000 counts</p> <p>True-rms voltages (V ac and V ac+dc)</p>	
		<p>Ranges</p> <p>Accuracy for 5 % to 100 % of range (DC coupled)</p> <p>Accuracy for 5 % to 100 % of range (AC or dc coupled)</p> <p>DC rejection (only VAC)</p> <p>Common mode rejection (CMRR)</p> <p>Full scale reading</p> <p>Peak</p> <p>Modes</p> <p>Ranges</p> <p>Accuracy</p> <p>Full scale reading</p> <p>Frequency (Hz)</p>	<p>500 mV, 5 V, 50 V, 500 V, 750 V</p> <p>DC to 60 Hz (V ac+dc) <math>\pm</math> (1 % +10 counts)</p>

		<p>Ranges</p> <p>Frequency range</p> <p>Accuracy @1 Hz to 1 MHz</p> <p>Full scale reading</p> <p>RPM</p> <p>Max reading</p> <p>Accuracy</p> <p>Duty cycle (PULSE)</p> <p>Range</p> <p>Frequency range</p>	
		<p>1 Hz to 60 Hz (V ac) <math>\pm</math> (1 % +10 counts)</p> <p>60 Hz to 20 kHz <math>\pm</math> (2.5 % +15 counts) &gt;50 dB &gt;100 dB @ dc</p>	
		<p>&gt;60 dB @ 50, 60, or 400 Hz</p> <p>5000 counts, reading is independent of any signal crest factor.</p> <p>Max peak, Min peak, or pk-to-pk</p> <p>500 mV, 5 V, 50 V, 500 V, 2200 V</p> <p>Accuracy Max peak or Min peak 5 % of full scale</p>	
		<p>Hz, 10 Hz, 100 Hz, 1 kHz, 10 kHz, 100 kHz, 1 MHz, 10 MHz, and 70 MHz</p> <p>15 Hz (1 Hz) to 50 MHz in continuous autose</p> <p><math>\pm</math> (0.5 % +2 counts)</p> <p>10 000 counts</p> <p>50.00 kRPM</p> <p><math>\pm</math> (0.5 % +2 counts)</p> <p>2 % to 98 %</p> <p>15 Hz (1 Hz) to 30 MHz in continuous autose</p>	
		Pulse width (PULSE)	
		<p>Frequency range</p> <p>Full scale reading</p> <p>Amperes (AMP)</p>	<p>15 Hz (1 Hz) to 30 MHz in continuous autose</p> <p>1000 counts</p>
		<p>With current clamp</p>	<p>Ranges same as V dc, V ac, V ac+dc, or PEAK</p>
		<p>Scale factors</p>	<p>0.1 mV/A, 1 mV/A, 10 mV/A, 100 mV/A, 400 mV/A, 1 V/A, 10 mV/mA</p>



		Accuracy	same as V dc, V ac, V ac+dc, or PEAK (add current clamp uncertainty)
		<p>Industrial Scope Meter® Hand-Held Oscilloscopes  Temperature (TEMP) with optional temperature probe  Range 200 °C/div (200 °F/div)  Scale factor 1 mV/°C and 1 mV/°F  Accuracy as V dc (add temp. probe uncertainty)  Decibel (dB)  0 dBV 1 V  0 dBm (600 Ω /50 Ω) 1 mW referenced to 600 Ω or 50 Ω  dB on V dc, V ac, or Vac+dc  Full scale reading 1000 counts  Crest factor (CREST)  Range 1 to 10  Full scale reading 90 Counts  Phase  Modes</p>	
		<p>A to B, B to A  0 to 359 degrees  1 degree  1 phase / 3 phase 3 conductor balanced loads (3 phase:  fundamental component only, AUTOSET mode  only)  Ratio between watts and VA range - 0.00 to 1.00  RMS reading of multiplying corresponding samples of  input A (volts) and input B (amperes)</p>	
		<p>Full scale reading 999 counts  Vrms x Arms</p>	
		<p>Full scale reading 999 counts  <math>\sqrt{((VA)^2 - W^2)}</math></p>	
		<p>Full scale reading 999 counts  to measure on pulse width modulated signals, like motor  drive inverter outputs  readings show the effective voltage based on the average  value of samples over a whole number of  periods of the fundamental frequency  as Vrms for sine wave signals</p>	
		<p>Range Resolution Power (B only)  Configurations Power factor (PF) Watt VA VA reactive  (var) Vpwm  Purpose Principle Accuracy Input A to common  Ohm (Ω)  Ranges</p>	
		<p>50 Ω to 5 MΩ - 5000 counts, 30 MΩ - 3000 counts  0.5 mA to 50 nA, decreases with increasing ranges&lt;4  V&lt;(30 Ω ± 5 Ω) in 50 Ω range  0.5 mA  ≥1 ms</p>	

		<p>50 Ω, 500 Ω, 5 kΩ, 50 kΩ, 500 kΩ, 5 MΩ, 30 MΩ  Accuracy ± (0.6 % + 5 counts) 50 Ω ±(2 % + 20 counts)  Full scale reading Measurement current Open circuit voltage Continuity (Cont)  Beep Measurement current Detection of shorts of Diode Measurement voltage</p>		
		<table border="1"> <tr> <td data-bbox="683 412 1010 450">@0.5 mA</td> <td data-bbox="1010 412 1401 450">&gt;2.8 V</td> </tr> </table>	@0.5 mA	>2.8 V
@0.5 mA	>2.8 V			
		<table border="1"> <tr> <td data-bbox="683 450 1010 562">@open circuit &lt;4 V 0.5 mA + on input A, - on COM</td> <td data-bbox="1010 450 1401 562"></td> </tr> </table>	@open circuit <4 V 0.5 mA + on input A, - on COM	
@open circuit <4 V 0.5 mA + on input A, - on COM				
		<p>Measurement current Polarity Capacitance (CAP)  Ranges 50 nF, 500 nF, 5 μF, 50 μF, 500 μF  Full scale reading 5000 counts  Measurement current 500 nA to 0.5 mA, increases with increasing ranges  Advanced meter functions  Zero Set Set actual value to reference  AutoHold (on A) Captures and freezes a stable measurement result. Beeps when stable. AutoHold works on the main  meter reading, with thresholds of 1 Vpp for AC signals and 100 mV for DC signals.  Fixed decimal point Activated by using attenuation keys.  Cursor Readout  Sources</p>		
		<p>A, B  Average, min and max readout</p>		
		<p>Average, min, max and time from start of readout (in ROLL mode; instrument in HOLD)</p>		
		<p>Min, max and time from start of readout (in RECORDER mode; instrument in HOLD)</p>		
		<p>Harmonics values in POWER QUALITY mode.  Peak-peak, time distance and reciprocal time distance readout</p>		
		<p>Average, min, max and time distance readout (in ROLL mode; instrument in HOLD)  High, low and peak-peak readout  Transition time, 0 %-level and 100 %-level readout (manual or auto leveling; auto leveling only possible in single channel mode)  As oscilloscope accuracy</p>		
		<p>Single vertical line Dual vertical lines Dual horizontal lines Rise or fall time Accuracy Recorder  The results are displayed as Chart recorder display that plots a graph of min and max values of Meter measurements over time or as a waveform recorder display that plots all the captured samples.  Meter readings</p>		

		<p>Measurement Speed  Record Size (min, max, average)  Recorded Time Span  Maximum number of events  Waveform record  Maximum sample rate  Size Internal memory  Span internal memory  Record Size SD card  Recorded Time Span SD card  Maximum number of events</p> <p>Readings  Watt, VA, var ranges (auto)</p>	<p>Maximum 2  measurements/s  2 M readings for 1  channel  2 weeks  1024</p>
		<p>400 K sample/s  400 M samples Recorded Time  15 minutes at 500 <math>\mu</math>s/div  1.5 G samples  11 hours at 500 <math>\mu</math>s/div  64</p>	
		<p>11 hours at 20 ms/div</p>	
		<p>14 days at 20 ms/div</p>	
		<p>Watt, VA, var, PF, DPF, Hz  250 W to 250 MW, 625 MW,  1.56 GW</p>	
		<p>when selected: total (%r)</p>	<p><math>\pm (2 \% + 6 \text{ counts})</math></p>
		<p>when selected: fundamental (%f)  <math>\pm (4 \% + 4 \text{ counts})</math>  0.00 to 1.00</p>	
		<p>DPF  PF 0.00 to 1.00, <math>\pm 0.04</math>  Frequency range 10.0 Hz to 15.0 kHz 40.0 Hz to 70.0 Hz  Number of Harmonics DC to 51  Readings / Cursor readings  (fundamental 40 Hz to 70 Hz)  V rms / A rms /Watt each harmonic from fundamental  maybe selected  for individual readings  Includes frequency of fundamental, phase Angle and  K-factor (in Amp and Watt)  type</p>	
		<p>Subtype Protocol  NEN-EN50295  ISO-11898  RS-422 EIA-422  RS-232  RS-232/EIA-232</p>	

		RS-485 H1 DP	RS-485/EIA-485 61158 type 1, 31.25 kBit EIA-485
		PA 61158 type 1 EIA-232 EIA-485	
		AS-i CAN Interbus S Modbus Foundation Field bus Profile bus RS-232 RS-485 Miscellaneous Display	
		Type	5.7-inch color active matrix TFT
		Resolution Vertical	640 x 480 pixels 10 div of 40 pixels
		Horizontal External	12 div of 40 pixels via Power Adapter BC430
		Input voltage	10 V DC to 21 V DC
		Power consumption	5 W typical
		Input connector	5 mm jack
		Internal	via Battery Pack BP290
		Battery power	Rechargeable Li-Ion 10.8 V
		Operating time	7 hours with 50 % backlight brightness
		Charging time	4 hours with test tool off, 7 hours with test tool on
		Allowable ambient temp Internal memory can store 20 data sets (screen waveform and setup) Size	0 to 40 °C (32 to 104 °F) during charging Micro SD card slot with optional SD card (max size of 32 GB) 259 mm x 132 mm x 55 mm (10.2 in x 5.2 in x 2.15 in)
		Weight Optically isolated	1.4 kg (3.2 lb) including battery pack Transfer screen copies (bitmaps), settings and data
		USB to PC/laptop	OC4USB optically isolated USB adapter/cable, (optional), using applicable software for Windows®.
		Optional WiFi adapter	Fast transfer of screen copies (bitmaps), settings and data to PC/laptop, tablet, smartphone, etc. A USB port is provided for attaching the WiFi dongle. Do not use the USB port

			with a cable for safety reasons.
		Waveform Display Power Memory Mechanical Interface Environmental Environmental MIL-PRF-28800F, Class 2	
		Temperature	
		Battery Operation	0 to 40 °C (32 to 104 °F)
		Power Adapter Operation	0 to 50 °C (32 to 122 °F)
		Storage @ 0 to 10 °C (32 to 50 °F)	-20 to 60 °C (-4 to 140 °F) noncondensing
		@ 10 to 30 °C (50 to 86 °F)	95 %
		@ 30 to 40 °C (86 to 104 °F)	75 %
		@ 40 to 50 °C (104 to 122 °F) @ -20 to 60 °C (-4 to 140 °F) Operating at 3 km (10 000 feet)	45 % noncondensing CAT III 600 V
		Operating at 2 km (6 600 feet)	CAT IV 600 V
		Storage International	12 km (40 000 feet) IEC 61326-1: Industrial, CISPR 11: Group 1, Class A
		Korea (KCC)	Class A Equipment (Industrial Broadcasting & Communication Equipment)
		USA (FCC) Frequency range	47 CFR 15 subpart B. This product is considered an exempt device per clause 15.103. 2412 MHz to 2462 MHz
		Output power IP51, ref: EN/IEC60529 General	<100 mW IEC 61010-1: Pollution Degree 2
		Measurement Direct on input or with leads	IEC 61010-2-033: CAT IV 600 V/CAT III 750 V 600 Vrms CAT IV for derating
		With Banana-to BNC Adapter BB120	600 Vrms for derating
		Max. floating voltage from any terminal to ground	600 Vrms CAT IV, 750 Vrms up to 400 Hz
		Humidity (Operating) Storage Altitude EMC electromagnetic compatibility	

		10:1 voltage probe AC Current Clamp
15	Current probes	Current probes AC/DC current probe, input 0-70A, RMS/100A, Peak AC/DC, Frequency DC to 100 kHz (@3dB), output 10mV/A, 100mV/A, CAT 3, working voltage 600V, Battery 9V.
16	Inductive load bank	Inductive load bank 60-600 mH (with adjustable at any value using a rotating mechanical arrangement using variable reluctance method), the inductor arrangement should be properly housed in a metallic tank, the output terminals should be mounted at top or front of the inductor load bank on a Bakelite sheet, saturation current rating 25A, Rated current rating 25A, CRGO laminations Core, Properly wounded with Copper wire, Properly insulated winding layers using proper insulating material.
17	Three Phase induction motor coupled with DC machine	3-Phase Induction motor coupled with DC Generator 3-Phase Induction Motor (of 5 H.P., 415V) Coupled with a DC generator of 5- H.P., 230V DC) properly mounted on an iron channel.
18	Single phase induction motor coupled with DC machine	Single phase induction motor coupled with DC machine Single Phase Induction Motor (of 3 H.P., 230V AC) Coupled with a DC generator of 3- H.P., 230V DC) properly mounted on an iron channel.
19	Inductors 0-25 mH, 25 A	Inductors 0-25 mH (with tapings at 2-4-8-12-16-20-25 mH) tapping terminals should be mounted at top of the inductor on a Bakelite sheet , saturation current rating 25A, Rated current rating 25A, CRGO laminations Core, Properly wounded with Copper wire, Properly insulated winding layers using proper insulating material.

#### Terms & Conditions for item no 1-10

- Access points (technical possible) should be available for Intermediate signaling points of the control and power circuit, if any, for the analysis purpose.
- Access points must be available on the front panel to register the transient changes in the system during the sudden load changes and dynamic situations.
- The enclosure of test setup should be fully transparent with metal base for better academic value addition and for better understanding of the students about the system.
- Supplier has to give full warranty of the system for Two Year.
- Some Additional Testing Points on the main Control Panel may be added by the technical members of the committee. No additional cost will be given for it.
- Firm must submitted the design of the outer panel.
- The detailed brochure of the quoted item with complete technical details/specification along with make & model number must be attached with the Bid-document otherwise Bid-document will not be considered.
- The technical members of the purchase committee may also ask any firm for the demonstration before finalization of the Bid, within 10 working days after opening of the tender. The cost for the demonstration will be borne by the supplier. If any firm fails to successfully demonstrate the system quoted by them, the Bid of that firm will not be considered.

- The real time experimental values of the output voltage, input voltage & firing angle (delay angle) must be displayed on the panel board using suitable meters.
- Scanned Copies of the entire experimental test reports as mentioned in the Technical Specification must be uploaded/attached otherwise Bid will not be considered.
- The Firm has to provide the detailed lab manual (in Hard as well as in soft Copy).
- Proper Training has to be given by the firm without any additional cost.
- **For item No.1, 3, 4, 6,7, 10**  
 The experimental test reports of the test Setup including waveforms of voltage & currents (at source side and load side) at different firing angles along with the tabulated values of voltage, current, power, PF, Crest factor , active power, reactive power, THD in output voltage, THD in output current, THD in Source Current at different firing angles (at least at five different firing angles at suitable interval of at least 20 degree and 40 degree for item no 7) must be attached along with the Bid-documents. The experimental waveforms validating the soft start feature of the system should also be attached with the Bid-documents. If the above said experimental reports of the setup will not be found attached along with the Bid-documents of any party/firm/company/vendor (participating in tendering process), the Bid-document of that firm will not considered.
- **For item No.2, 5, 8, 9**  
 The experimental test reports (hardware results recorded on power analyzer) of the test setup including waveforms (source and load side) of voltage & currents at different values of duty cycle along with the tabulated values of voltage, current, power, PF, Crest factor , active power, reactive power, THD in output voltage, THD in output current, THD in Source Current at different values of duty cycle (at least at five different duty cycle at suitable intervals) must be attached along with the Bid-documents. If the above said experimental reports of the setup will not be found attached along with the Bid-documents of any party/firm/company/vendor (participating in tendering process), the Bid-document of that firm will not considered .
- Incomplete or partial bidding will not be accepted; in such case the bid will not be considered.

**FORMAT FOR QUOTATION SUBMISSION**  
(In letterhead of the supplier with seal)

Date: \_\_\_\_\_

To: \_\_\_\_\_  
\_\_\_\_\_

Sl. No.	Description of goods \ (with full Specifications)	Qty.	Unit	Quoted Unit rate in Rs. (Including Ex-Factory price, excise duty, packing and forwarding, transportation, insurance, other local costs incidental to delivery and warranty/ guaranty commitments)	Total Price (A)	Sales tax and other taxes payable	
						In %	In figures (B)
<b>Total Cost</b>							

Gross Total Cost (A+B): Rs. \_\_\_\_\_

We agree to supply the above goods in accordance with the technical specifications for a total contract price of Rs. \_\_\_\_\_ (Amount in figures) (Rupees \_\_\_\_\_ amount in words) within the period specified in the Invitation for Quotations.

We confirm that the normal commercial warranty/ guarantee of \_\_\_\_\_ months shall apply to the offered items and we also confirm to agree with terms and conditions as mentioned in the Invitation Letter.

We hereby certify that we have taken steps to ensure that no person acting for us or on our behalf will engage in bribery.

Signature of Supplier

Name: \_\_\_\_\_

Address: \_\_\_\_\_

Contact No. \_\_\_\_\_