

# Gautam Buddha University

(Established by the Uttar Pradesh Gautam Buddha University Act 2002  
UP Act No. 9 of 2002, passed by the Uttar Pradesh Legislature)

Greater Noida – 201 312, Ph. 0120-2344200

Website : [www.gbu.ac.in](http://www.gbu.ac.in)

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## BID FORM

SUPPLY & INSTALLATION OF EQUIPMENT FOR POWER ELECTRONICS  
LAB., SCHOOL OF ENGINEERING

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<b>Tender</b>	<b>SUPPLY &amp; INSTALLATION OF EQUIPMENT FOR POWER ELECTRONICS LAB., SCHOOL OF ENGINEERING</b>
<b>Opening Date of Bid</b>	16.02.2024
<b>Last date &amp; Time of Bid Submission</b>	29.02.2024 upto 3.30 p.m.
<b>Technical Bid Opening Date, Time &amp; Place</b>	29.02.2024 at 04.30 p.m.  Venue : Conference Room of the Registrar Office, 1 <sup>st</sup> Floor, Administrative Building, G.B.U., Gr. Noida.  (Bidder/authorized representative of bidders may attend the bid opening proceedings on the above mentioned day and time).
<b>Estimated Cost</b>	Rs.4,57,934.00 (Rupees Four Lakh Fifty Seven Thousand Nine Hundred Thirty Four Only – incl. of GST)
<b>Time of Completion</b>	Two months
<b>Earnest Money Deposit Tender Fee</b>	Rs.5,500.00 (Rupees Five Thousand Five Hundred only)- (Refundable)  Rs. 1,000.00 + @18% GST = Rs.1,180/- (One Thousand One Hundred Eighty only – incl. of GST) - (Non-refundable)
<b>Bid System</b>	Two Tier : 1) Technical Bid 2) Financial Bid
<b>Bank Account Detail for submission of Tender Fee and Earnest Money Deposit (through NEFT/RTGS only)</b>	Punjab National Bank, Gautam Buddha University, Greater Noida (U.P.) A/C No. 6660000100000681, IFSC Code: : PUNB0666000

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## CHECK LIST

(Please mark number on each page submitted for the support of bid)

Total BID Pages : .....

Sr. No.	Document Name	Page No.
1	Tender fee through NEFT/RTGS only in prescribed account of Gautam Buddha University of <b>Amount Rs.1000.00 + @18% GST= Rs.1,180/- (Rupees One Thousand One Hundred Eighty Only-incl. of GST)</b> as per terms and conditions enclosed scan copy.	
2	Earnest Money through NEFT/RTGS only in prescribed account of Gautam Buddha University of <b>Amount Rs.5,500.00 (Rupees Five Thousand Five Hundred Fifty only)</b> as per terms and conditions enclosed scan copy.	
3	Filled up bidder's Performa ( <b>i.e. page no. 3,4 &amp; 5</b> ) appended with the tender	
4	Detail of the similar type of items supplied / installed / maintained during three years out of last four financial years at IITs, NIT's or Central / State Universities / Organization / any Academic Institute of National Repute / Reputed private organizations etc. Three purchase order/supply order out of last four financial years)	
5	Audited balance sheet counter signed by C.A. for three years out of last four financial years clearly indicating turnover and T.D.S. along with Form 3CB and 3CD. Average turnover should be at least 30% of the estimated cost during the last three financial years out of last four financial years.	
6	Attached PAN, OEM/Authorization Certificate & GST/IGST Registration Copy	
7	The vendor shall submit an affidavit (duly notarized) on Rs.10/- stamp paper as per below format only ( <b><i>the affidavit issues date/notarize date should not be earlier than the tender advertisement date</i></b> ): <b><i>"I/We hereby confirm and declare that M/s. .... proprietor/partner(s) is/are not blacklisted/de-registered/debarred by any Government department/Public Sector Undertaking, Universities, Institution and College or any other reputed organization for which we have executed/undertaken the works/services during the last four financial years"</i></b>	

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## “BIDDER’S PROFORMA”

Name of the Organization			
Pl. mentioned whether a Government Company / Public Ltd. / Private Ltd. / Partnership / Proprietorship			
Specify the number of years in this line of activity by the company			
PAN registration Number			
GST / IGST registration Number			
Provide the postal address, telephone & fax numbers, and email address of the nearest office			
Are you the manufacturer / authorized dealer / distributor/ retailer for the product quoted (please attached relevant certificate):			
Whether technical specification are attached with Technical Bid or not.			
Deviations in specifications, if yes, please mention in separate sheet.			
Audited balance sheet counter signed by C.A. for three years out of last four financial years clearly indicating turnover and T.D.S. along with Form 3CB and 3CD. If the figures for 2022-23 are not available then they may furnish financial statement of year 2019-20. Average financial turnover should be at least 30% of the estimated cost during the last three consecutive financial years out of four financial years.	<b>2020-21</b>	<b>2021-22</b>	<b>2022-23</b>

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Detail of the similar type of items supplied / installed / maintained during three years out of last four financial years at IITs, NIT's or Central / State Universities / Organization / any Academic Institute of National Repute / Reputed private organizations etc.

**(enclose three purchase order/supply order out of last four financial years)**

Nature of work & name of organization	Amount of work done (lakh Rs.)	Contract Period	Name & Contact No. of the client
Whether your firm has been blacklisted by any Government Organization including Universities, Institutions and Colleges during last four financial years.			<b>(Yes / No)</b>

## DECLARATION

I/We hereby declare that the information given in the technical bid by the undersigned is correct and fulfill all conditions as published in the tender document.

## ACCEPTANCE

I/We accept the above terms and conditions and shall comply with them strictly.

(SIGNATURE OF THE BIDDER)

WITH SEAL

NAME: .....

ADDRESS : .....

Tel./Mobile No.: ..... Email ID : .....

## **BANK DETAILS OF VENDORS, in case of refund of EMD**

Bank A/c Name : .....

Bank Name : .....

Bank Account No. : .....IFSC Code : .....

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## GENERAL TERMS AND CONDITIONS

1. Detailed information about the items, specifications are available in tender document which can be downloaded from the University website [www.gbu.ac.in](http://www.gbu.ac.in).
2. Offer should be submitted in two parts, in two separate envelopes; 1) **Technical Bid** and 2) **Financial Bid**. These two envelopes shall be sealed in a common cover and addressed/sent to “**The Registrar, Gautam Buddha University, Greater Noida, Gautam Budh Nagar -201312 (U.P.)**” super scribing “**Tender against Tender Advt. GBU/S&P/01/2024 dated 15.02.2024, Name of work : Supply & Installation of Equipment for POWER ELECTRONICS LAB., SCHOOL OF ENGINEERING**” so as to reach us on or before last day of submission.
3. The Technical Bid and Financial Bid should be duly filled up.
4. The technical bid of the bidders will be opened first and the financial bid will be opened only of technically qualified.
5. List of Documents to be submitted by tenderer to qualify the Eligibility Criteria :

### A. TECHNICAL BID

- i. The tenderer shall have to pay tender document fee of **Rs. 1,000.00 + @18% GST = Rs.1,180/- (Rupees One Thousand One Hundred Eighty only – incl. of GST)** through NEFT/RTGS only payable in favour of Gautam Buddha University in the A/C No 6660000100000681, IFSC Code: PUNB0666000, Punjab National Bank, Gautam Buddha University, Greater Noida. The copy of NEFT/RTGS with transaction ID must be enclosed along with the bid. This tender document fee will be non-refundable. Bid without tender fee in the prescribe form will not be accepted.
- ii. The tenderer shall have to furnish, as part of its bid, a bid security/EMD of **Rs. 5,500.00 (Rupees Five Thousand Five Hundred only)** through NEFT/RTGS only in favour of Gautam Buddha University in the A/C No. 6660000100000681, IFSC Code: : PUNB0666000, Punjab National Bank, Gautam Buddha University, Greater Noida. The copy of NEFT/RTGS with transaction ID must be enclosed along with the bid.
- iii. Filled up bidder’s proforma (page no. 3, 4, 5 & 6) appended with the tender.
- iv. Purchase Order of works satisfactorily completed for three years out of the last four financial years at IITs, NIT’s or Central / State Universities / Organization / any Academic Institute of National Repute / Reputed private organizations etc.
- v. Audited balance sheet counter signed by C.A. for three years out of last four financial years clearly indicating turnover and T.D.S. along with Form 3CB and 3CD. The cumulative turnover during last three consecutive years should be 30% of the estimated value.
- vi. OEM/Authorized Firm Authorization Certificate.
- vii. PAN Certificate of the individual/Company/Firm.
- viii. The tenderer should submit the G.S.T. /I.G.S.T registration certificate.
- ix. The vendor shall submit an affidavit (duly notarized) on Rs.10/- stamp paper to the effect that the firm has never been blacklisted by any Government organization including

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Universities, Institutions and Colleges, as per below format (*the affidavit issues date/notarize date should not be earlier than the tender advertisement date*):

*“I/We hereby confirm and declare that M/s. ....  
proprietor/partner(s) is/are not blacklisted/de-registered/debarred by any  
Government department/Public Sector Undertaking, Universities, Institution and  
College or any other reputed organization for which we have executed/undertaken  
the works/services during the last four financial years”*

## **B. PRICE BID**

- i. Price bid duly filled in all respects in tender. The price shall be in words and numeric numbers both.
6. Offer should be sent in a sealed envelope, submitted either in person or by post on which name and address of the supplier/firm shall be written. Tenders received through E-mails or FAX will not be considered.
7. The rate quoted should be F.O.R. Gautam Buddha University (Gautam Buddha Nagar, Greater Noida, UP) in rupees inclusive of all charges e.g. packing, forwarding local taxes, railway freight, transit insurance etc. The total price should include all accessories required for final installation of the item. **Rates of imported goods should be quoted excluding custom duty, as this University is exempted from payment of custom duty (by letter of Department of Scientific and Industrial Research, Ministry of Science & Technology, GOI).**
8. The technical bids will be opened on scheduled date and time in the presence of the bidders/authorized representatives of bidders. Suppliers intending to attend the tender opening should intimate in advance.
9. The EMD of the successful bidder will be refunded after getting the “Performance Security Deposit (i.e. 10% of PO/WO value)”. The Performance Security Deposit shall be deposited in the form of FDR/Bank Guaranty only, pledged in favour of “Gautam Buddha University” and should be valid for whole contract/warranty period. The PSD will be returned only after expiry of the successful contract/warranty period. The EMD of the unsuccessful bidders will be returned to the firm(s) immediately after finalization of the tenders. No interest will be paid on EMD in any case.
10. Detailed specifications with the mention of make and model/Version of each item should be clearly given supported by the illustrated pamphlets wherever possible. Quotations without specified make and Model/Version and other particulars may be rejected. The accessories included in the Equipments/Instruments should also be clearly mentioned.
11. Losses or damage in transit will be borne by the Supplier. The supplier may, if he so desires, get the goods insured and include such charges in the tendered rate.
12. Offered prices should be valid for at least 180 days from the last date of receipt of tenders.
13. a) The items delivery time should be preferably within stipulated period mentioned in purchase order, if fails  
b) The Penalty Clause is as under:-

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Should the bidder fail to deliver the goods within stipulated period, the Competent Authority may, at his discretion, allow an extension in time subject to recovery from the bidder as agreed liquidated damages, and not by way of penalty, a sum equal to the percentage of the value of tender amount which the bidder has failed to supply for period of delay as stated below:-

- |  |  |
|--|--|
| i. Delay up to one week                                    | 1%   |
| ii. Delay exceeding one week but not exceeding two weeks   | 2%   |
| iii. Delay exceeding two weeks but not exceeding one month | 5%   |
| iv. Delay exceeding one month                              | 5% for each month and part there of subject to maximum 10% |

c) In case of failure to supply the goods within stipulated delivery period and in accordance with the specifications given in the quotations, the University shall be free to cancel the order.

13. Supply of the placed order in part will not be accepted.
14. No advance payment shall be released in any case. The payment shall be released on delivery of items in good condition, installation and putting those in satisfactory working conditions only.
15. No increase in price will be allowed after our purchase order(s) are placed.
16. Warranty certificate against all the Items/Equipment/Instruments developed defects covering warranty period, which commences from the date of installation shall be given at the time of supply of the items.
17. During the warranty period whenever the firm is called upon to attend to the rectification of the defects/faults in the consignments, the firm shall attend to the repair work within a period of a week. They should render timely back up service whenever called upon. A certificate to the effect should be attached to the tender.
18. A certificate to the effect that items supplied is fully operational and no additional accessory or space is required to fully functioning the Equipments/Instruments should be issued along with the delivery challans/invoice. GBU reserves the right to refuse payment in the event of not furnishing this certificate at the time of supply.
19. Complete user, technical and service manuals/installation drawings/documentation and spare parts catalogue are to be provided along with the supply of the item.
20. Failure to comply with all the terms and conditions mentioned herein would result in the tender being summarily rejected.
21. Conditional tenders will not be accepted.
22. GBU reserves the right to change the order quantity or split the orders among multiple vendors



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without assigning any reason (s) whatsoever.

23. GBU reserves the right to reject any or all the tenders without assigning any reasons whatsoever.
24. All legal proceedings, if necessity arises to the University may be any of the parties (University or Contractor/Supplier) shall have to be lodged in the courts situated at Distt. Gautam Budh Nagar and not elsewhere.

**REGISTRAR**

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## TECHNICAL SPECIFICATION

Power Electronics Lab		Qty
S.No.	Particulars	
1	<p><b>Study of V-I characteristics for SCR,IGBT,TRAIAC,DIAC,MOSFET</b></p> <p><b>SALIENT FEATURES</b></p> <ul style="list-style-type: none"><li>• Aesthetically designed injection molded electronic desk (Main unit) carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure, &amp; has colorful screw less overlay showing circuit &amp; its connection tag numbers for easy connectivity.</li><li>• Connection through Sturdy 4mm Banana Sockets &amp; Patch Cords.<ul style="list-style-type: none"><li>•Set of Users Guide provided with each Unit.</li></ul></li></ul> <p><b>SPECIFICATIONS OF MAIN UNIT</b></p> <p><b>•Built in Power Supply :</b> DC Supply :5V / 1A. &amp; ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated),0 to 30V DC (Variable), 100 mA (Isolated High Volt DC 15V to 110V, 100Ma,AC Supply : 12-0-12V AC,150 mA. Short circuit Protected.</p> <p><b>•Built in Function Generator –</b> O/p Waveform : Sine, Triangle &amp; TTL O/Ps Output Frequency : 1 Hz to 1MHz in 6 ranges, with amplitude &amp; frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV ( + 50% modulation)</p> <p><b>•Clock Generator :</b> 10 MHz TTL clock.</p> <p><b>•Data Switches (10 No.) &amp; bi-colour LED status indicators 10X2 Nos, for High / Low indication.</b></p> <p><b>•Pulser switches (2 Nos.) with four debounced outputs - 2No.</b></p> <p><b>•BNC to 2 channel banana adapter - 2No.</b></p> <p><b>•Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDsto indicate status.</b></p> <p><b>•2 / 4 digit 7 segment display with BCD to 7 segment decoder.</b></p> <p><b>•Onboard DPMs provided with mode/range selection.</b> (A) DC volt : 2V/200V - 1No. (B) DC current : 2mA/200mA - 1No. (C) DC Volts/Current : 20V/200mA - 1No.</p> <p><b>•Onboard moving iron meters provided for</b> (A) AC Current : 1 AMP - 1No. (B) AC Voltage : 15V - 1No.</p> <p><b>•Onboard speaker : 8 Ohms, 0.5 Watt (1No.)</b></p> <p><b>•Onboard POTS : 1K - 1No. 1M - 1No.</b></p>	02

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	<ul style="list-style-type: none"><li>•Operating Voltage: 220/240Vac switch settable <math>\pm 10\%</math>, 50Hz/60VA.</li></ul> <p><b>Magnetism, Electromagnetism &amp; Transformer Experiment Panel :</b> Faraday's law of magnetic induction, Left-hand rule for north pole of coils / conductors &amp; Corkscrew rule for flux around current carrying conductor. Fleming's left-hand rule (motor law -force on a current carrying conductor in a magnetic field), Lenz's Law. Transformer: <b>MARS</b> BH curve, calculation of total Iron core loss (Hyst &amp; Eddy loss) using CRO, DC-AC resistance, transformation ratio, loading of transformer, Auto transformer, self &amp; mutual inductance calculations. Magnetic sensor: Reed switch, Electromagnetic Relay, Hall sensor (Analog /Digital), Mag. compass needle.</p>	
2	<p><b>To study single phase bridge inverter</b></p> <p><b>Features</b></p> <ul style="list-style-type: none"><li>➤ Aesthetically designed injection molded electronic desk.</li><li>➤ Master unit carrying useful experiment resources like line Synchronized firing circuits, Power supplies, lamp load, RLC loads, Battery Charging supply etc. while the central slot will hold replaceable experiment panels.</li><li>➤ Each multi experiment panel is secured in an ABS molded plastic sturdy enclosure, and has colorful screw less overlay showing circuit &amp; Connection through Sturdy 4mm Banana Sockets &amp; Patch Chords.</li><li>➤ Set of User Guide provided with each unit.</li></ul> <p><b>Power Scope</b> Accessory for any Lab CRO for off ground differential measurements upto 1000Vdc to facilitate checking inverter / converter waveform.</p> <p><b>Master Unit</b> <b>Built in power supply</b></p> <ul style="list-style-type: none"><li>• DC supply : + 12V, 500mA,</li><li>• Unregulated Power supply 17V / 750mA,</li><li>• Regulated 7VDC to 14VDC/3A O/P is provided as 12V Battery charging supply. In absence of battery, same may be used as simulated battery source to run experiments on inverters etc.</li><li>• Isolated DC supply +12V/ 300mA with isolated common.</li></ul> <p>d Inverter transformer of Primary &amp; Secondaries: 12-11-0-11-12/3A.</p> <ul style="list-style-type: none"><li>• On board o/p to Isolated Drive Circuit</li></ul> <p><b>AC supply</b></p> <ul style="list-style-type: none"><li>• 230V AC line voltage is made available on two banana 4mm sockets as well as 1.5A fuse extender for variac if used.</li><li>• Aux DC Power Supply : (Useful as field / armature supply for DC motor)</li><li>• Variable upto 200Vdc/0.5Amp (Phase controlled Thyristor half bridge)</li><li>• Field ON/OFF control with field failure relay &amp; over current protection circuit.</li></ul> <p><b>LSPT Panel consisting of</b></p>	01

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- Two pulse transformers of 1:1:1 are provided for isolation & supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector.
- Selector switch of 2 pole 6 way for selecting different types of firing pulses like out of phase inverter firing using LM3525 with dead time, freq. Control in freq variation from 170 Hz to 250Hz, 12.5/25/6..25 Hz Frequency gated with High Frequency (3KHz) for Cycloconverter, line Synchronized UJT firing for converter and pulse width

### Load Panel

- Load resistor of 10ohm/ 40W and 100ohm / 10W - 1No. each
- Centre tapped 3A choke 4mH/ 16mH each -2Nos.
- DC choke 0-100-200 mH/750mA- 1No.
- Commutation capacitors of 10uF/100V - 4Nos.
- AC Paper capacitor of 4uF/440V - 1No.
- DC Cap 220uF / 63V- 1No.
- Diode BYT 71 (5407)- 1 No.
- On board Lamp load of 15W/ 230VAC provided

### Accessories:

- 15 pin D connector cable assembly,
- 4mm patchcords : 100mm X 10 Nos & 500mm X 20 Nos.

### CON / INV Panel

- SCR Converters - Provided with sturdy 800V/12A SCRs (4nos) with uncommitted snubbers, 6A diodes (2nos) commutation switch, 47µF/450V cap, Ramp Cosine firing circuit. However actual working currents are limited to 3A (max) for safety.
- Half Wave & Full Wave Fully Controlled converter
- AC Voltage Controller using Lamp
- SCR Controlled Converter 1 phase with R-L Load
- Effect of Free Wheeling Diode on SCR converter performance with Inductive load.
- Study of SCR converter (Open Loop) output with Inductance Input and Capacitance Input filters
- Effect of Source Impedance on performance of SCR converters.
- Study of closed loop SCR converters with Resistive Load.
- Study of closed loop SCR converters with Motor Load. Select motor types from.
- Study of full wave -half controlled SCR bridge.
- Resonant DC- DC converter.
- Advanced firing Schemes
- Study of H.F. gate type SCR triggering.
- Study of relation between control voltage and SCR converter output DC voltage - using linear resistor controlled synchronized ramp firing (IC815 equivalent).
- Study of Linear relation between control voltage and SCR converter

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	<p>output- using cosine firing scheme.</p> <ul style="list-style-type: none"><li>• SCR forced Commutation Techniques</li><li>• Study of forced commutation techniques for SCR, Class A,B,C,D,E,F</li><li>• SCR based Inverters</li><li>• SCR based Parallel Inverter.</li><li>• SCR based series Inverter .</li><li>• SCR based Bridge Inverter.</li><li>• SCR based McMurray Bedford half bridge inverter.</li><li>• Cycloconverter</li><li>• SCR Based cycloconverter</li><li>• SCR based Chopper</li><li>• SCR based buck (step dn), boost (set up), buck boost chopper</li></ul>	
<b>3</b>	<p><b>To study Morgen chopper circuit</b></p> <p><b>Features</b></p> <ul style="list-style-type: none"><li>➤ Aesthetically designed injection molded electronic desk.</li><li>➤ Master unit carrying useful experiment resources like line Synchronized firing circuits, Power supplies, lamp load, RLC loads, Battery Charging supply etc. while the central slot will hold replaceable experiment panels.</li><li>➤ Each multi experiment panel is secured in an ABS molded plastic sturdy enclosure, and has colorful screw less overlay showing circuit &amp; Connection through Sturdy 4mm Banana Sockets &amp; Patch Chords.</li><li>➤ Set of User Guide provided with each unit.</li></ul> <p><b>Power Scope</b></p> <ul style="list-style-type: none"><li>• Accessory for any Lab CRO for off ground differential measurements upto 1000Vdc to facilitate checking inverter / converter waveform.</li></ul> <p><b>Master Unit</b></p> <p><b>Built in power supply</b></p> <ul style="list-style-type: none"><li>• DC supply : + 12V, 500mA,</li><li>• Unregulated Power supply 17V / 750mA,</li><li>• Regulated 7VDC to 14VDC/3A O/P is provided as 12V Battery charging supply. In absence of battery, same may be used as simulated battery source to run experiments on inverters etc.</li><li>• Isolated DC supply +12V/ 300mA with isolated common.</li><li>• On board Inverter transformer of Primary &amp; Secondaries: 12-11-0-11-12/3A.</li><li>• On board o/p to Isolated Drive Circuit</li></ul> <p><b>AC supply</b></p> <p>230V AC line voltage is made available on two banana 4mm sockets as well as 1.5A fuse extender for variac if used.</p> <ul style="list-style-type: none"><li>• Aux DC Power Supply : (Useful as field / armature supply for DC motor)</li><li>• Variable upto 200Vdc/0.5Amp (Phase controlled Thyristor half bridge)</li><li>• Field ON/OFF control with field failure relay &amp; over current protection</li></ul>	<b>01</b>

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circuit.

## LSPT Panel consisting of

- Two pulse transformers of 1:1:1 are provided for isolation & supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector.
- Selector switch of 2 pole 6 way for selecting different types of firing pulses like out of phase inverter firing using LM3525 with dead time, freq. Control in freq variation from 170 Hz to 250Hz, 12.5/25/6..25 Hz Frequency gated with High Frequency (3KHz) for Cycloconverter, line Synchronized UJT firing for converter and pulse width

## Load Panel

- Load resistor of 10ohm/ 40W and 100ohm / 10W - 1No. each
- Centre tapped 3A choke 4mH/ 16mH each -2Nos.
- DC choke 0-100-200 mH/750mA- 1No.
- Commutation capacitors of 10uF/100V - 4Nos.
- AC Paper capacitor of 4uF/440V - 1No.
- DC Cap 220uF / 63V- 1No.
- Diode BYT 71 (5407)- 1 No.
- On board Lamp load of 15W/ 230VAC provided

## Accessories:

- 15 pin D connector cable assembly,
- 4mm patchcords : 100mm X 10 Nos & 500mm X 20 Nos.

## CON / INV Panel

- SCR Converters - Provided with sturdy 800V/12A SCRs (4nos) with uncommitted snubbers, 6A diodes (2nos) commutation switch, 47µF/450V cap, Ramp Cosine firing circuit. However actual working currents are limited to 3A (max) for safety.
- Half Wave & Full Wave Fully Controlled converter
- AC Voltage Controller using Lamp
- SCR Controlled Converter 1 phase with R-L Load
- Effect of Free Wheeling Diode on SCR converter performance with Inductive load.
- Study of SCR converter (Open Loop) output with Inductance Input and Capacitance Input filters
- Effect of Source Impedance on performance of SCR converters.
- Study of closed loop SCR converters with Resistive Load.
- Study of closed loop SCR converters with Motor Load. Select motortypes from.
- Study of full wave -half controlled SCR bridge.
- Resonant DC- DC converter.
- Advanced firing Schemes
- Study of H.F. gate type SCR triggering.
- Study of relation between control voltage and SCR converter output DC output- using cosine firing scheme.

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Website : [www.gbu.ac.in](http://www.gbu.ac.in)

	<ul style="list-style-type: none"><li>• SCR forced Commutation Techniques</li><li>• Study of forced commutation techniques for SCR, Class A,B,C,D,E,F</li><li>• SCR based Inverters</li><li>• SCR based Parallel Inverter.</li><li>• SCR based series Inverter .</li><li>• SCR based Bridge Inverter.</li><li>• SCR based McMurray Bedford half bridge inverter.</li><li>• Cycloconverter</li><li>• SCR Based cycloconverter</li><li>• SCR based Chopper</li><li>• SCR based buck (step dn), boost (set up), buck boost choppervoltage - using linear resistor controlled synchronized ramp firing (IC815 equivalent).</li><li>• Study of Linear relation between control voltage and SCR converter</li></ul>	
4	<p><b>To study single phase cyclo converter with R &amp; RL Load</b></p> <p><b>Features</b></p> <ul style="list-style-type: none"><li>➤ Aesthetically designed injection molded electronic desk.</li><li>➤ Master unit carrying useful experiment resources like line Synchronized firing circuits, Power supplies, lamp load, RLC loads, Battery Charging supply etc. while the central slot will hold replaceable experiment panels.</li><li>➤ Each multi experiment panel is secured in an ABS molded plastic sturdy enclosure, and has colorful screw less overlay showing circuit &amp; Connection through Sturdy 4mm Banana Sockets &amp; Patch Chords.</li><li>➤ Set of User Guide provided with each unit.</li></ul> <p><b>Power Scope</b></p> <ul style="list-style-type: none"><li>• Accessory for any Lab CRO for off ground differential measurements upto 1000Vdc to facilitate checking inverter / converter waveform.</li></ul> <p><b>Master Unit</b></p> <p><b>Built in power supply</b></p> <ul style="list-style-type: none"><li>• DC supply : + 12V, 500mA,</li><li>• Unregulated Power supply 17V / 750mA,</li><li>• Regulated 7VDC to 14VDC/3A O/P is provided as 12V Battery charging supply. In absence of battery, same may be used as simulated battery source to run experiments on inverters etc.</li><li>• Isolated DC supply +12V/ 300mA with isolated common.</li><li>• On board Inverter transformer of Primary &amp; Secondaries: 12-11-0-11-12/3A.</li><li>• On board o/p to Isolated Drive Circuit</li></ul> <p><b>AC supply</b></p> <ul style="list-style-type: none"><li>• 230V AC line voltage is made available on two banana 4mm sockets as well as 1.5A fuse extender for variac if used.</li><li>• Aux DC Power Supply : (Useful as field / armature supply for DC motor)</li><li>• Variable upto 200Vdc/0.5Amp (Phase controlled Thyristor half bridge)</li></ul>	01

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	<ul style="list-style-type: none"><li>• Field ON/OFF control with field failure relay &amp; over current protection circuit.</li></ul> <p><b>LSPT Panel consisting of</b></p> <ul style="list-style-type: none"><li>• Two pulse transformers of 1:1:1 are provided for isolation &amp; supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector.</li><li>• Selector switch of 2 pole 6 way for selecting different types of firing pulses like out of phase inverter firing using LM3525 with dead time, freq. Control in freq variation from 170 Hz to 250Hz, 12.5/25/6..25 Hz Frequency gated with High Frequency (3KHz) for Cycloconverter, line Synchronized UJT firing for converter and pulse width</li></ul> <p><b>R-L-C Load Panel</b></p> <ul style="list-style-type: none"><li>• Load resistor of 10ohm/ 40W and 100ohm / 10W - 1No. each</li><li>• Centre tapped 3A choke 4mH/ 16mH each -2Nos.</li><li>• DC choke 0-100-200 mH/750mA- 1No.</li><li>• Commutation capacitors of 10uF/100V - 4Nos.</li><li>• AC Paper capacitor of 4uF/440V - 1No.</li><li>• DC Cap 220uF / 63V- 1No.</li><li>• Diode BYT 71 (5407)- 1 No.</li><li>• On board Lamp load of 15W/ 230VAC provided</li></ul> <p><b>Accessories:</b></p> <ul style="list-style-type: none"><li>• 15 pin D connector cable assembly,</li><li>• 4mm patchcords : 100mm X 10 Nos &amp; 500mm X 20 Nos.</li></ul> <p><b>CON / INV Panel</b></p> <ul style="list-style-type: none"><li>• SCR Converters - Provided with sturdy 800V/12A SCRs (4nos) with uncommitted snubbers, 6A diodes (2nos) commutation switch, 47µF/450V cap, Ramp Cosine firing circuit. However actual working currents are limited to 3A (max) for safety.</li><li>• Half Wave &amp; Full Wave Fully Controlled converter</li><li>• AC Voltage Controller using Lamp</li><li>• SCR Controlled Converter 1 phase with R-L Load</li><li>• Effect of Free Wheeling Diode on SCR converter performance with Inductive load.</li><li>• Study of SCR converter (Open Loop) output with Inductance Input and Capacitance Input filters</li><li>• Effect of Source Impedance on performance of SCR converters.</li><li>• Study of closed loop SCR converters with Resistive Load.</li><li>• Study of closed loop SCR converters with Motor Load. Select motor types from.</li><li>• Study of full wave -half controlled SCR bridge.</li><li>• Resonant DC- DC converter.</li><li>• Advanced firing Schemes</li><li>• Study of H.F. gate type SCR triggering.</li><li>• Study of relation between control voltage and SCR converter output DC</li></ul>	
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	<p>voltage - using linear resistor controlled synchronized ramp firing (IC815 equivalent).</p> <ul style="list-style-type: none"><li>• Study of Linear relation between control voltage and SCR converter output- using cosine firing scheme.</li><li>• SCR forced Commutation Techniques</li><li>• Study of forced commutation techniques for SCR, Class A,B,C,D,E,F</li><li>• SCR based Inverters</li><li>• SCR based Parallel Inverter.</li><li>• SCR based series Inverter .</li><li>• SCR based Bridge Inverter.</li><li>• SCR based McMurray Bedford half bridge inverter.</li><li>• Cycloconverter</li><li>• SCR Based cycloconverter</li><li>• SCR based Chopper</li><li>• SCR based buck (step dn), boost (set up), buck boost chopper</li></ul>	
5	<p><b>Three Phase (Half &amp; Fully) controlled bridge converter</b></p> <p><b>Features:</b></p> <ul style="list-style-type: none"><li>• Facilitates easy &amp; safe wiring by students due to use of 4mm sturdy Shrouded banana patch cords &amp; shrouded socket arrangements for high voltage circuits</li><li>• Each panel has ABS molded plastic sturdy enclosure, &amp; colorful screwless overlays showing circuits diagrams &amp; its connection tag numbers for easy understanding &amp; connection</li><li>• Set of Instructor Guide &amp; Student Workbook</li><li>• Set of Instructor Guide &amp; Student Workbook.</li><li>• Supplied with power scope attachment to any lab CRO for H V Differential voltage off- ground measurements.</li><li>• Trainer should be modular panels for easy site servicing not close control;panel box no wiring should not be there &amp; shrouded 4 mm banana patchcords &amp; shrouded sockets arrangements for the safety of the students</li></ul> <p><b>TECHNICAL SPECIFICATIONS</b></p> <p><b>Input 3 phase DOL Starter panel</b></p> <ul style="list-style-type: none"><li>• 4 Pole MCB of 415V/4A.</li><li>• DOL 9A contactor with 230V/50Hz/11VA COIL.</li><li>• Bimetallic thermal O/L relay with range 1.4A-2.3A.</li></ul> <p><b>DC voltmeter &amp; DC ammeter panel</b></p> <ul style="list-style-type: none"><li>• DC voltmeter (0-600V)</li><li>• DC Ammeter (0-5A) with polarity protection diode</li></ul> <p><b>Lamp Load</b> 230V/15/40/60/100W X3 bulbs with individual ON/OFF using 6A toggleswitch.</p> <p><b>Inductive (L) Load</b></p> <ul style="list-style-type: none"><li>• Inductive load=0.75W/3H/300mAX3Nos.</li></ul> <p><b>3 Ph. Bidirectional power cum Energy meter panel</b></p> <ul style="list-style-type: none"><li>• Bidirectional Multifunction • 3 Phase ¾ wire, 415V CT Input 5A</li><li>• LCD/LED display, Aux. supply 230V, 45-65 Hz, 5W</li></ul>	01

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	<ul style="list-style-type: none"><li>• V, I, Hz, Pf, KVA, KW, KWh</li></ul> <b>6 SCR Firing/Synchronizing Panel</b> <ul style="list-style-type: none"><li>• Mode selection switches (3 nos) to select cyclo converter, converter or disable.</li><li>• Cosine firing scheme to facilitate linear control for better harmonic ripple control.</li><li>• Cyclo converter frequency generator 25Hz/12.5Hz/6.25Hz</li><li>• Mode selection switched (3 Nos.) to select Cyclo converter frequencies, converter mode or disable.</li><li>• In built firing angle control pot.</li><li>• Facility to apply external 0 to 2.5V signal from DAC to control firing angle.</li></ul> <b>6 SCR/Diode Power Module</b> <ul style="list-style-type: none"><li>• Consist of 6 SCR [Anode to body type] with PIV rating 1200V/25A.</li><li>• 6 Diode with PIV rating of 1200V/16Amp</li><li>• 6 No. of uncommitted Snubbers for protection of thyristors consisting of capacitor 0.1uF/1000V &amp; 100E/5W ceramic resistors.</li></ul> <b>External Interface : I/P Fault Switches :</b> <p>3 Nos. PTs arranged in circuit 230V: 12-0-12@50mA</p> <b>List of Experiment</b> <p><b>1) Working with 3 Phase HVDC :</b></p> <p>a) 3 Ph. half wave uncontrolled converter with Resistive load using diodes. b) 3 Ph. full wave diode bridge (uncontrolled converter) with Resistive load. c) Study of SCR firing circuits in 3-ph. converter environment.</p> <p>3 Ph. half / fully wave fully controlled / half controlled SCR converter with Resistive Load &amp; motor load .</p>	
6	<b>To study single phase Mc-murray Bed ford full bridge inverter</b> <b>Features</b> <ul style="list-style-type: none"><li>➤ Aesthetically designed injection molded electronic desk.</li><li>➤ Master unit carrying useful experiment resources like line Synchronized firing circuits, Power supplies, lamp load, RLC loads, Battery Charging supply etc. while the central slot will hold replaceable experiment panels.</li><li>➤ Each multi experiment panel is secured in an ABS molded plastic sturdy enclosure, and has colorful screw less overlay showing circuit &amp; Connection through Sturdy 4mm Banana Sockets &amp; Patch Chords.</li><li>➤ Set of User Guide provided with each unit.</li></ul> <b>Power Scope</b> <ul style="list-style-type: none"><li>• Accessory for any Lab CRO for off ground differential measurements upto 1000Vdc to facilitate checking inverter / converter waveform.</li></ul> <b>Master Unit</b> <b>Built in power supply</b> <ul style="list-style-type: none"><li>• DC supply : + 12V, 500mA,</li><li>• Unregulated Power supply 17V / 750mA,</li></ul>	01

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- Regulated 7VDC to 14VDC/3A O/P is provided as 12V Battery charging supply. In absence of battery, same may be used as simulated battery source to run experiments on inverters etc.
- Isolated DC supply +12V/ 300mA with isolated common.
- On board Inverter transformer of Primary & Secondaries: 12-11-0-11-12/3A.
- On board o/p to Isolated Drive Circuit

#### AC supply

- 230V AC line voltage is made available on two banana 4mm sockets as well as 1.5A fuse extender for variac if used.
- Aux DC Power Supply :  
(Useful as field / armature supply for DC motor)
- Variable upto 200Vdc/0.5Amp (Phase controlled Thyristor half bridge)
- Field ON/OFF control with field failure relay & over current protection circuit.

#### LSPT Panel consisting of

- Two pulse transformers of 1:1:1 are provided for isolation & supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector.
- Selector switch of 2 pole 6 way for selecting different types of firing pulses like out of phase inverter firing using LM3525 with dead time, freq. Control in freq variation from 170 Hz to 250Hz, 12.5/25/6..25 Hz Frequency gated with High Frequency (3KHz) for Cycloconverter, line Synchronized UJT firing for converter and pulse width

#### Load Panel

- Load resistor of 10ohm/ 40W and 100ohm / 10W - 1No.each
- Centre tapped 3A choke 4mH/ 16mH each -2Nos.
- DC choke 0-100-200 mH/750mA- 1No.
- Commutation capacitors of 10uF/100V - 4Nos.
- AC Paper capacitor of 4uF/440V - 1No.
- DC Cap 220uF / 63V- 1No.
- Diode BYT 71 (5407)- 1 No.
- On board Lamp load of 15W/ 230VAC provided

#### Accessories:

- 15 pin D connector cable assembly,
- 4mm patchcords : 100mm X 10 Nos & 500mm X 20 Nos.

#### CON / INV Panel

- SCR Converters - Provided with sturdy 800V/12A SCRs (4nos) with uncommitted snubbers, 6A diodes (2nos) commutation switch, 47uF/450V cap, Ramp Cosine firing circuit. However actual working currents are limited to 3A (max) for safety.
- Half Wave & Full Wave Fully Controlled converter
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	<ul style="list-style-type: none"><li>• SCR Controlled Converter 1 phase with R-L Load</li><li>• Effect of Free Wheeling Diode on SCR converter performance with Inductive load.</li><li>• Study of SCR converter (Open Loop) output with Inductance Input and Capacitance Input filters</li><li>• Effect of Source Impedance on performance of SCR converters.</li><li>• Study of closed loop SCR converters with Resistive Load.</li><li>• Study of closed loop SCR converters with Motor Load. Select motortypes from.</li><li>• Study of full wave -half controlled SCR bridge.</li><li>• Resonant DC- DC converter.</li><li>• Advanced firing Schemes</li><li>• Study of H.F. gate type SCR triggering.</li><li>• Study of relation between control voltage and SCR converter output DC voltage - using linear resistor controlled synchronized ramp firing (IC815 equivalent).</li><li>• Study of Linear relation between control voltage and SCR converter output- using cosine firing scheme.</li><li>• SCR forced Commutation Techniques</li><li>• Study of forced commutation techniques for SCR, Class A,B,C,D,E,F</li><li>• SCR based Inverters<ul style="list-style-type: none"><li>• SCR based Parallel Inverter.</li><li>• SCR based series Inverter .SCR based Bridge Inverter.</li><li>• SCR based McMurray Bedford half bridge inverter.</li></ul></li><li>• Cycloconverter</li><li>• SCR Based cycloconverter</li><li>• SCR based Chopper</li><li>• SCR based buck (step dn), boost (set up), buck boost chopper</li></ul>	
7	<p><b>Study &amp; analysis of single phase ac voltage controller using SCR &amp; TRAIC</b></p> <p><b>Features</b></p> <ul style="list-style-type: none"><li>➤ Aesthetically designed injection molded electronic desk.</li><li>➤ Master unit carrying useful experiment resources like line Synchronized firing circuits, Power supplies, lamp load, RLC loads, Battery Charging supply etc. while the central slot will hold replaceable experiment panels.</li><li>➤ Each multi experiment panel is secured in an ABS molded plastic sturdy enclosure, and has colorful screw less overlay showing circuit &amp; Connection through Sturdy 4mm Banana Sockets &amp; Patch Chords.</li><li>➤ Set of User Guide provided with each unit.</li></ul> <p><b>Power Scope</b></p> <ul style="list-style-type: none"><li>• Accessory for any Lab CRO for off ground differential measurements upto 1000Vdc to facilitate checking inverter / converter waveform.</li></ul> <p><b>Master Unit</b></p>	01

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## **Built in power supply**

- DC supply : + 12V, 500mA,
- Unregulated Power supply 17V / 750mA,
- Regulated 7VDC to 14VDC/3A O/P is provided as 12V Battery charging supply. In absence of battery, same may be used as simulated battery source to run experiments on inverters etc.
- Isolated DC supply +12V/ 300mA with isolated common.
- On board Inverter transformer of Primary & Secondaries: 12-11-0-11-12/3A.
- On board o/p to Isolated Drive Circuit

## **AC supply**

- 230V AC line voltage is made available on two banana 4mm sockets as well as 1.5A fuse extender for variac if used.
- Aux DC Power Supply :  
(Useful as field / armature supply for DC motor)
- Variable upto 200Vdc/0.5Amp (Phase controlled Thyristor half bridge)
- Field ON/OFF control with field failure relay & over current protection circuit.

## **LSPT Panel consisting of**

- Two pulse transformers of 1:1:1 are provided for isolation & supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector.
- Selector switch of 2 pole 6 way for selecting different types of firing pulses like out of phase inverter firing using LM3525 with dead time, freq. Control in freq variation from 170 Hz to 250Hz, 12.5/25/6..25 Hz Frequency gated with High Frequency (3KHz) for Cycloconverter, line Synchronized UJT firing for converter and pulse width

## **R-L-C Load Panel**

- Load resistor of 10ohm/ 40W and 100ohm / 10W - 1No. each
- Centre tapped 3A choke 4mH/ 16mH each -2Nos.
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- Commutation capacitors of 10uF/100V - 4Nos.
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- DC Cap 220uF / 63V- 1No.
- Diode BYT 71 (5407)- 1 No.
- On board Lamp load of 15W/ 230VAC provided

## **Accessories:**

- 15 pin D connector cable assembly,
- 4mm patchcords : 100mm X 10 Nos & 500mm X 20 Nos.

## **CON / INV Panel**

- SCR Converters - Provided with sturdy 800V/12A SCRs (4nos) with uncommitted snubbers, 6A diodes (2nos) commutation switch,

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	<p>47<math>\mu</math>F/450V cap, Ramp Cosine firing circuit. However actual working currents are limited to 3A (max) for safety.</p> <ul style="list-style-type: none"><li>• Half Wave &amp; Full Wave Fully Controlled converter</li><li>• AC Voltage Controller using Lamp</li><li>• SCR Controlled Converter 1 phase with R-L Load</li><li>• Effect of Free Wheeling Diode on SCR converter performance with Inductive load.</li><li>• Study of SCR converter (Open Loop) output with Inductance Input and Capacitance Input filters</li><li>• Effect of Source Impedance on performance of SCR converters.</li><li>• Study of closed loop SCR converters with Resistive Load.</li><li>• Study of closed loop SCR converters with Motor Load. Select motortypes from.</li><li>• Study of full wave -half controlled SCR bridge.</li><li>• Resonant DC- DC converter.</li><li>• Advanced firing Schemes</li><li>• Study of H.F. gate type SCR triggering.</li><li>• Study of relation between control voltage and SCR converter output DC voltage - using linear resistor controlled synchronized ramp firing (IC815 equivalent).</li><li>• Study of Linear relation between control voltage and SCR converter output- using cosine firing scheme.</li><li>• SCR forced Commutation Techniques</li><li>• Study of forced commutation techniques for SCR, Class A,B,C,D,E,F</li><li>• SCR based Inverters</li><li>• SCR based Parallel Inverter.</li><li>• SCR based series Inverter .</li><li>• SCR based Bridge Inverter.</li><li>• SCR based McMurray Bedford half bridge inverter.</li><li>• Cycloconverter</li><li>• SCR Based cycloconverter</li><li>• SCR based Chopper</li><li>• SCR based buck (step dn), boost (set up), buck boost chopper</li></ul> <p><b>Triggering circuit / dv/dt Protection panel</b></p> <ul style="list-style-type: none"><li>• SCR Triggering Schemes / turn ON methods.</li><li>• Simple Resistance firing circuit for upto 900 SCR firing half wave. Resistance - Capacitor firing circuit with increased control SCR firing - half Wave &amp; full wave.</li><li>• UJT/PUT based SCR Trigger with series/ shunt transistor controlledramp, resistance controlled Pedestal</li><li>• TRIAC Triggering Schemes / turn ON methods.</li><li>• Simple Resistance firing circuit for TRIAC firing Full wave.</li><li>• UJT/PUT based TRIAC Trigger with series/ shunt transistor controlledramp, resistance controlled Pedestal</li></ul>	
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	<ul style="list-style-type: none"><li>• dv/dt behaviour of SCR</li><li>• Study of SCR dv/dt protection using gate termination.</li><li>• Study of SCR dv/dt protection using gate reverse bias with resistance.</li><li>• Study of SCR dv/dt protection using gate reverse bias with resistance and diode.</li><li>• Study of SCR dv/dt protection using polarised snubber.</li><li>• Study of SCR dv/dt protection using polarised RC snubber with discharge resistor.</li></ul> <p>Study of Triac dv/dt protection using RC Snubber.</p>	
8	<p><b>Analysis of single phase (Half &amp; Fully) controlled bridge converter with R,RL Load at different firing angle</b></p> <p><b>Features</b></p> <ul style="list-style-type: none"><li>➤ Aesthetically designed injection molded electronic desk.</li><li>➤ Master unit carrying useful experiment resources like line Synchronized firing circuits, Power supplies, lamp load, RLC loads, Battery Charging supply etc. while the central slot will hold replaceable experiment panels.</li><li>➤ Each multi experiment panel is secured in an ABS molded plastic sturdy enclosure, and has colorful screw less overlay showing circuit &amp; Connection through Sturdy 4mm Banana Sockets &amp; Patch Chords.</li><li>➤ Set of User Guide provided with each unit.</li></ul> <p><b>Power Scope</b></p> <ul style="list-style-type: none"><li>• Accessory for any Lab CRO for off ground differential measurements upto 1000Vdc to facilitate checking inverter / converter waveform.</li></ul> <p><b>Master Unit</b></p> <p><b>Built in power supply</b></p> <ul style="list-style-type: none"><li>• DC supply : + 12V, 500mA,</li><li>• Unregulated Power supply 17V / 750mA,</li><li>• Regulated 7VDC to 14VDC/3A O/P is provided as 12V Battery charging supply. In absence of battery, same may be used as simulated battery source to run experiments on inverters etc.</li><li>• Isolated DC supply +12V/ 300mA with isolated common.</li><li>• On board Inverter transformer of Primary &amp; Secondaries: 12-11-0-11-12/3A.</li><li>• On board o/p to Isolated Drive Circuit</li></ul> <p><b>AC supply</b></p> <ul style="list-style-type: none"><li>• 230V AC line voltage is made available on two banana 4mm sockets as well as 1.5A fuse extender for variac if used.</li><li>• Aux DC Power Supply : (Useful as field / armature supply for DC motor)</li><li>• Variable upto 200Vdc/0.5Amp (Phase controlled Thyristor half bridge)</li><li>• Field ON/OFF control with field failure relay &amp; over current protection circuit.</li></ul> <p><b>LSPT Panel consisting of</b></p>	1

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	<p>Two pulse transformers of 1:1:1 are provided for isolation &amp; supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector.</p> <ul style="list-style-type: none"><li>• Selector switch of 2 pole 6 way for selecting different types of firing pulses like out of phase inverter firing using LM3525 with dead time, freq. Control in freq variation from 170 Hz to 250Hz, 12.5/25/6..25 Hz Frequency gated with High Frequency (3KHz) for Cycloconverter, lineSynchronized UJT firing for converter and pulse width</li></ul> <p style="text-align: center;"><b>Load Panel</b></p> <ul style="list-style-type: none"><li>• Load resistor of 10ohm/ 40W and 100ohm / 10W - 1No.each</li><li>• Centre tapped 3A choke 4mH/ 16mH each -2Nos.</li><li>• DC choke 0-100-200 mH/750mA- 1No.</li><li>• Commutation capacitors of 10uF/100V - 4Nos.</li><li>• AC Paper capacitor of 4uF/440V - 1No.</li><li>• DC Cap 220uF / 63V- 1No.</li><li>• Diode BYT 71 (5407)- 1 No.</li><li>• On board Lamp load of 15W/ 230VAC provided</li></ul> <p><b>Accessories:</b></p> <ul style="list-style-type: none"><li>• 15 pin D connector cable assembly,</li><li>• 4mm patchcords : 100mm X 10 Nos &amp; 500mm X 20 Nos.</li></ul> <p><b>CON / INV Panel</b></p> <ul style="list-style-type: none"><li>• SCR Converters - Provided with sturdy 800V/12A SCRs (4nos) with uncommitted snubbers, 6A diodes (2nos) commutation switch, 47µF/450V cap, Ramp Cosine firing circuit. However actual working currents are limited to 3A (max) for safety.</li><li>• Half Wave &amp; Full Wave Fully Controlled converter</li><li>• AC Voltage Controller using Lamp</li><li>• SCR Controlled Converter 1 phase with R-L Load</li><li>• Effect of Free Wheeling Diode on SCR converter performance with Inductive load.</li><li>• Study of SCR converter (Open Loop) output with Inductance Input and Capacitance Input filters</li><li>• Effect of Source Impedance on performance of SCR converters.</li><li>• Study of closed loop SCR converters with Resistive Load.</li><li>• Study of closed loop SCR converters with Motor Load. Select motortypes from.</li><li>• Study of full wave -half controlled SCR bridge.</li><li>• Resonant DC- DC converter.</li><li>• Advanced firing Schemes</li><li>• Study of H.F. gate type SCR triggering.</li><li>• Study of relation between control voltage and SCR converter output DC voltage - using linear resistor controlled synchronized ramp firing (IC815 equivalent).</li><li>• Study of Linear relation between control voltage and SCR converter</li></ul>	
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	<p>output- using cosine firing scheme.</p> <ul style="list-style-type: none"><li>• SCR forced Commutation Techniques</li><li>• Study of forced commutation techniques for SCR, Class A,B,C,D,E,F</li><li>• SCR based Inverters</li><li>• SCR based Parallel Inverter.</li><li>• SCR based series Inverter .</li><li>• SCR based Bridge Inverter.</li><li>• SCR based McMurray Bedford half bridge inverter.</li><li>• Cyclo converter</li><li>• SCR Based cyclo converter</li><li>• SCR based Chopper</li><li>• SCR based buck (step dn), boost (set up), buck boost chopper</li></ul>	
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## FINANCIAL BID OF

### SUPPLY & INSTALLATION OF EQUIPMENT FOR POWER ELECTRONICS LAB, SoE

S.NO.	ITEM DESCRIPTION	QTY	Quoted Model & Make	Unit Price (in Rs.)	Total Price (in Rs.)
1	Study of V-I characteristics for SCR,IGBT,TRAIC,DIAC,MOSFET	02			
2	To study single phase bridge inverter	01			
3	To study Morgan chopper circuit	01			
4	To study single phase cyclo converter with R & RL Load	01			
5	Three Phase (Half & Fully) controlled bridge converter	01			
6	To study single phase Mc-murray Bed ford full bridge inverter	01			
7	Study & analysis of single phase ac voltage controller using SCR & TRAIC	01			
8	Analysis of single phase (Half & Fully) controlled bridge converter with R,RL Load at different firing angle	01			
9				<u>GST @ .....</u>	
10				<u>Grand Total</u>	

Total cost of the offer is Rs. \_\_\_\_\_ in words (Rupees \_\_\_\_\_)

\_\_\_\_\_. I abide by all the terms & conditions of the tender.

(SIGNATURE OF THE BIDDER)  
WITH SEAL

NAME: .....