

# MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY JAIPUR

No. F5(864)ST/MNIT/EE/2021

Phone : 0141-2713312,2713352

## NOTICE INVITING QUOTATIONS

**Registrar, MNIT, JLN Marg, Jaipur** invites sealed tenders for the supply of “**Equipment**” for **Power Electronics and Electrical Drives Laboratories** for **Electrical Engineering Department** of this Institute in **Two Bid System (Technical & Financial bids in separate envelop)** as per schedule given below.

Event	Date & Time
Download of Tender	07.01.2022
Pre-Bid Meeting Date & Time	17.01.2022 by 2.00 PM
Bid Submission Last Date& Time	28.01.2022 by 2.00 PM
Technical Bid Opening Date & Time	28.01.2022 at 3.00 PM
Financial Bid Opening	Will be intimated later on
Earnest Money	Rs. 30,000/- in the name of The Registrar, MNIT and payable at Jaipur <b>(Kindly attached the RTGS details with cancelled cheque along with the Earnest Money)</b>

Quotation must be enclosed in a properly sealed envelope address to the MNIT, Jaipur with kind attention to **Deputy Registrar (S&P), MNIT, Jawahar Lal Nehru Marg, Jaipur -302017** (E-mail address [storepurchase@mnit.ac.in](mailto:storepurchase@mnit.ac.in)) by designation and not by name. The quotations must be super scribed “Quotations for the supply of **Equipment** ----- as called for in Tender Notice No. ----- dated \_\_\_\_\_”DUE ON----- AT -----AM/PM. The Quotation must reach on or before -----AM/ PM on or before the due date and time mentioned in the tender notice/tender document. The documents must be dropped in the tender box available in Central Store during office hours (9.30am to 6.00pm) on all working days. Bids delivered to any other place or any individual shall not be considered as valid document. Quotations sent by e-mail will not be considered valid. The complete Tender document can be viewed and downloaded only from the website ([www.mnit.ac.in](http://www.mnit.ac.in)) and CPPP site <https://eprocure.gov.in/epublish/app> during the tender period.

## GENERAL TERMS & CONDITIONS

1. **THE RATES QUOTED SHOULD BE F.O.R. JAIPUR inclusive of all charges related to transportation from your end to MNIT, Jaipur in Indian rupees. For imported items, the rates are to be quoted CIF(Cost, Insurance & Freight) Delhi only in freely convertible foreign currencies. In case the rates are quoted CIF (Cost, Insurance & Freight) New Delhi, then it will be the responsibility of the supplier to intimate us well in advance prior to dispatch and submission of all the relevant documents in time which will be required in clearing the consignment from Custom. If, there is delay in sending the documents and demurrage is imposed, then it will be in the account of foreign supplier. Kindly note that if any amendment is required in LC, after its establishment, the Bank Charges in this respect will be in the account of beneficiary only.** Bid shall always be both in the figures and words. The words “No quotations” should be written across any or all of the items in the schedule for which a tender does not wish to tender.
2. As far as possible, bid should be given for goods of India manufacture which are readily available. Foreign goods quoted and proposed to be supplied should be covered by normal import quota of the dealer. This institute is exempted from payment of custom duty.
3. Detailed specifications and "make" of each item should be clearly given supported by the illustrated pamphlets wherever possible. Bid without specifying the make and other particulars may be rejected. The accessories included in the equipment should also be clearly mentioned.
4. Losses or damage in transit will be in to the account of the supplier in case of rates **F.O.R. JAIPUR**. The supplier may, if he so desires, get the goods insured
5. The payment for the ordered items would be made after the articles have been received, found in order and its successful installation.Payment will be made by RTGS to indigenous suppliers. Kindly send the RTGS details and cancelled cheque along with the Invoice.**The payment to foreign supplier will be made through FDD/Wire Transfer OR Letter of Credit as the case may be. However 90 percent payment will be released after receipt of items and remaining 10 present after its successfully installation**
6. Your rates should be valid at least for three months (minimum) from the last date of opening of bid.
7. All legal proceedings, if necessity arises to institute may be any of the parties (Institute or Contractor/Supplier) shall have to be lodged in the courts situated at Jaipur and not elsewhere.
8. The institute is not bound to accept the lowest tender and may reject any tender or any part of the tender without giving any justification for such an action.

9. (a) The Penalty Clause is as under:-

If the seller fails to deliver any or all of the Goods/Services within the original /re-fixed delivery period specified in the Purchase Order, this Institute will be entitled to deduct/recover the Liquidated Damages for the delay at the following percentage:

(i)	Delay up to one month	1%
(ii)	Delay exceeding one month but not exceeding two month	2%
(iii)	Delay exceeding two month but not exceeding three month	5%
(iv)	Delay exceeding three month	5% for each month and part there of subject to maximum 10%

- (b) In case of failure to supply the goods within the prescribed time and in accordance with the specifications give in the Quotations, the institute shall be free to cancel the order and make purchases from the next higher tenderer or from the open market as the case may be. In that case the loss sustained by the institute shall be recovered from the defaulting supplier. The institute will be at liberty to recover the loss from the permanent earnest money/or any other pending claims of the supplier without prejudice to its general right to affect recovery from the supplier.
10. The prospective bidders can be those who are the manufacturers of the equipment. For items manufactured outside India, the manufacturer itself can be a bidder or its authorised Indian agent can bid on behalf of its Principal that is the manufacturer.
11. In the event, the country of origin of goods is India, only the manufacturers shall be considered eligible for bidding. Authorised agents of Indian manufacturers may be permitted to submit the bid, provided the concerned manufacturer states that as its policy, it does not bid itself in India and that there is no qualitative difference between manufacturer and its agent as bidder in respect of quality of supplies, cost, and responsibility of maintenance and servicing. The Indian manufacturer must describe the alternatives in clear terms, in the event the bidding agent ceases to continue as agent of the concerned manufacturer within the stipulated warranty period.
12. If any Indian manufacturer requires importing an essential part from a foreign country, the said company may be given to enjoy the benefit of customs duty exemption with the aid of CDEC of MNIT, Jaipur provided the import of the concerned item is done on behalf of MNIT, Jaipur.

13. **THERE IS TWO BID SYSTEM:-**

**(TECHNICAL AND FINANCIAL BID, both bids should be submitted in separate envelopes):**

**(A) Technical Bid:**

- a) Bidder must be a manufacturer/authorized distributor/ Dealers and they have to enclose a certificate of authorization of manufacturer in format at **Annexure – A (Authorization certificate in any other format will not be valid)**. OEM itself or any one authorised dealer on behalf of OEM may participate in bid. OEM and its dealers both may not participate at the same time.

- b) The manufacturers should supply documentary proof i.e. Registration with the Registrar of Industries, National Small Scale Industries Corporation or with penal of MNIT in case of manufacturer. Offers other than the manufacturers should be supported with an authority letter from the manufacturers, authorizing them to quote rates standing guarantee for the satisfactory execution of supply orders failing which offers are liable to be ignored.
- c) One declaration by the Manufacturer to the extent that in case of failure of its local agent /office to provide service support to the satisfaction of MNIT Jaipur, it shall make immediate arrangement for required service support.
- d) **Bidder should enclose technical compliance from the Manufacturer. The specifications of items should be strictly as specified. Deviation, if any may please be mentioned separately. If there is no deviation than it should be mentioned as “No Deviation”.**
- e) The leaflets catalogue, related to quoted equipment/model etc. should be sent invariably, so that a proper evaluation of the equipment offered is possible.
- f) Mention must be made of the pre-installation requirements for the equipment quoted viz. ambient temperature, humidity, weather specifications, power specifications, civil works etc. When items are provided full performance satisfaction should be demonstrated.
- g) Bidder must enclose the acceptance of terms and conditions and must enclose the duly signed and stamped tender document.
- h) All the Annexure enclosed should be duly filled up and signed.
- i) Please attach proof/certificate of each condition required in the tender document.
- j) The firm should provide approximate area required for the setting/installation of the machine / equipment.
- k) Installation support and demonstration for utilizing the equipment is also needed
- l) To mention, if any additional setup/infra is required before installation of equipment (esp. Foundation etc. For larger m/c)
- m) Bidder shall enclose Earnest Money Deposit (EMD)

**(B) Financial Bid:**

- a) The rates to be quoted by the bidder should be clearly mentioned without any overwriting
- b) If there is any cutting in the price box, issued be duly signed
- c) The bidders should clearly mentioned their payment terms & conditions
- d) The GST or any other taxes including Custom duty Etc. should be mentioned clearly

14. **Delivery Period:-**The ordered quantity of stores must be delivered within 12 to 14 weeks in the case of indigenous equipment and 14 to 16 weeks in the case of imported equipment after opening of L.C. / FDD and Wire Transfer. The extension of delivery period after placing the PO, if required, will be considered only on genuine reasons and proper justifications only.

15. **Installation:** - Successful BIDDER shall depute concerned specialist, for supervision of erection & commissioning of the machine to be carried out as and when necessary. The successful BIDDER shall make necessary arrangements during the entire warranty period at their own expenses for stay, transport and other expenses of their specialist during their stay in Jaipur;

16. **Warranty:** All the bidders are required to provide minimum **01 Year + 60 Days** warranty on the quoted equipment / instrument
17. **Performance Bank guarantee**  
Successful Bidder has to Provide Performance security @ **10%** of the equipment cost, valid for stipulated warranty period plus 60 days which should be in the form of Bank's Guarantee from a commercial bank in format at **Annexure – B**. Warranty will cover repair/replacement of all defective parts, if any, with the same or equivalent make for any part removed. Maintenance will be provided at site. The supplier will provide after sale service during the warranty period from nearest place to installation. The supplier will attend the complaint within 24 working hours and not beyond 5 working days.
18. **EARNEST MONEY:** A Demand Draft of Rs.**30,000/-** from a Commercial bank only in the name of the Registrar, M.N.I.T. and payable at Jaipur may please be sent along with your tender as Earnest Money **No tender shall be considered without earnest money / tender fee. Cheques are not accepted as earnest money amount.** No interest is payable by us on the amount of earnest money. **Kindly attach the RTGS details with cancelled cheque along with the Earnest Money.** The firms registered with NSIC/MSME are exempted for furnishing of EMD / Tender Fee. The Hard copy of NSIC/MSME registration certificate is to be enclosed in technical bid positively.
19. **Jurisdiction:** The Courts of Jaipur alone will have the jurisdiction to try any matter, dispute or difference between the parties arising out of this tender/contract. It is specifically agreed that no Court outside and other than Jaipur court shall have jurisdiction in the matter.
20. **Arbitration Clause: - In the eventuality of any dispute, the sole Arbitrator shall be MNIT, Jaipur and his decision shall be binding on all the parties.**
21. **Force Majeure :** Any failure of omission or commission to carry out the provision of this contract by the supplier shall not give rise to any claim by one party, one against the other, if such failure of omission or commission arises from an act of God; which shall include all acts of nature calamities such as fire, flood, earthquake, hurricane, or nay pestilence or from civil strikes, compliance with any statute and / or regulations of the Government, lockouts and strikes, riots, embargoes or from any political or other reason beyond the supplier's control including war (whether declared or not) civil war or stage of insurrection, provided that notice of the occurrence of any event by either party to the other shall be given within two weeks from the date of occurrence of such an event which could be attributed to Force Majeure conditions.
22. **Risk & Cost :** In the event of failure to carry out the contractual obligations, within the stipulated period or extended period and determination of the contract for any reason, violation of warranties etc. the MNIT Jaipur shall have the right to carry out the unfinished obligation at the exclusive - cost and risk of the bidder/firm, after due notice and the difference so accrued shall be recoverable from the bidder/firm.
23. The material found defective upon opening by the supplier representative in presence of Central stores personnel / indenter of MNIT Jaipur or not as per tendered specifications will have to be lifted back by the supplier at their own cost and risk. The material lying in MNIT Jaipur premises would be at supplier's risk and cost.

24. **Custom Duty** : The MNIT, Jaipur is a public funded research Institution registered with Department of Scientific & Industrial Research and concessional Custom Duty @5.15% is applicable for the goods purchased for research purpose vide Government of India Notification No.51/96-Customs dated 23.07.1996
25. **GST**:MNIT, Jaipur is a public funded research Institution registered with Department of Scientific & Industrial Research for concessional GST @5% applicable for the goods purchased for research purpose vide Ministry of Finance (Department of Revenue) Notification No.47/2017-Integrated Tax dated 14.11.2017 & Notification No.45/2017-Central Tax dated 14.11.2017.
26. **Bid Validity**: 90 days (Minimum)
27. **Opening of Bids**: The Bids shall be opened by authorised officials of the institute as per schedule given in Date Sheet. In case, the day of bid opening is declared a holiday by the government, the Bids will be opened on the next working day at the same time. No separate intimation shall be sent to the bidders in this regard. Only opening of bids and accepting the bid will not mean that the firm is technically or financially qualified.
28. **Institute right to vary Quantities at Time of Award or later** : Institute reserves the right at the time of awarding the contract to increase or decrease the quantity of goods and services originally mentioned in our NIT without any change in unit price or other terms and conditions.
29. While submitting the tender, the **GST Registration No., PAN No.&E-mail Address** is to be mentioned by the bidder positively. Failing this, there bid will be treated as non responsive.
30. **After Sales Service Certificate** :After sales service certificate is to be furnished by successful bidder in the prescribed form as **annexure –C**
31. **PREFERENCE TO MAKE IN INDIA:**

This Order is issued pursuant to Rule 153 (iii) of the General Financial Rules 2017

Public Procurement (Preference to Make in India), Order 2017 and Public procurement policy for micro and small enterprises (MSEs) as per guideline shall be applicable. For details visit website: [www.msme.gov.in](http://www.msme.gov.in)

- a. In reference to the Govt. of India fresh initiative “Atmanirbhar Bharat” only items with minimum 20% domestic value addition / local content can participate in public procurement unless global bid are invited. Also items with more than 50% local content will get purchase preference over other items.

Local content means the amount of value added in India which shall, unless otherwise prescribed by the Nodal Ministry, be the total value of the item procured (excluding net domestic indirect taxes) minus the value of imported content in the item (including all customs duties) as a proportion of the total value, in percent. Bidder has to mentioned whether they fall in Class-I local supplier, Class-II or Non – Local supplier.

**Class-I local supplier**, means a supplier or service provider, whose goods, services or works offered for procurement, has local content equal to or more than 50%.

Class-II local supplier, means a supplier or service provider, whose goods, services or works offered for procurement, has local content more than 20% but less than 50%.

Non-Local supplier, means a supplier or service provider, whose goods, services or works offered for procurement. Has less than or equal to 20%.

Verification of Local Content:-

The Class-I local supplier / Class-II local supplier, shall be required to indicate percentage of local content and provide self-certification that the item offered meets the local content requirement for Class-I Local supplier / Class-II local supplier, They shall also give details of the locations (s) at which the local value addition is made.

The above mentioned documents at Sl. 1. (i), (ii) are to be submitted along with bid positively.

32. Specification Enclosed as annexure – D

Deputy Registrar  
(Store & Purchase)

**MANUFACTURERS' AUTHORIZATION FORM**

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

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

Tender No. :[insert number from Invitation For Bids]

To : [insert complete name and address of Purchaser]

**WHEREAS**

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

We hereby extend our full guarantee and warranty in accordance with Clause 2.20 of the General Conditions of Contract, with respect to the Goods offered by the above firm.

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

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

Title: [insert title]

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

Dated on \_\_\_\_\_ day of \_\_\_\_\_, \_\_\_\_\_ [insert date of signing]

\*(Not required in case the bidder itself is the manufacturer)



**PERFORMANCE BANK GUARANTEE**

(To be executed on Stamp Paper of Rs. 100/- or such higher value as per the Stamp Act of the State in which the Guarantee is issued. Stamp Paper should be in the name of the Bank Issuing the Guarantee.)

BANK GUARANTEE NO. :

DATED :

Dear Sirs,

1. THIS DEED OF GUARANTEE made on this ..... day of..... between **MALAVIYA NATIONAL INSTITUTE OF TECHNOLOGY, JAIPUR** (hereinafter called the "MNIT" which expression shall unless excluded by or repugnant to the context includes its successors and assignees) of the one part and the ..... (hereinafter called the "Bank" which expression shall unless excluded by or repugnant to the context include its successors and assignees) of the other part.

2. AND WHEREAS as per clause \_\_\_\_\_ of the purchase order in question the supplier shall furnish a Performance Bank Guarantee of 3% of P.O. Value i.e. Rs. .... (Rs.....

..... only) valid for the period of two months beyond warranty period as and by way of security for satisfactory working of the ..... AND WHEREAS at the request of the supplier, the Bank executes these presents.

3.0 THIS DEED WITNESSETH AND IT IS HEREBY AGREED AND DECLARED BY AND BETWEEN PARTIES HERETO AS FOLLOWS:

3.1 The Bank hereby guarantees to the MNIT, Jaipur that the equipment / service contracted are capable of performing the work as demanded by the MNIT, Jaipur. In the event of equipment / service failing to perform to the satisfaction of the MNIT, Jaipur, which shall be final and conclusive of the factum of non-performance, the Bank shall indemnify and keep the indemnified to the extent of ..... of P.O. Value i.e. Rs. .... (Rupees .....) valid for the period of two months beyond the warranty period against any loss or damage that may be caused to or suffered by the MNIT, Jaipur consequent to non-performance of the contracted equipment / services to be supplied by the supplier.

3.2 In consideration of the aforesaid premise and at the request of the supplier, we the Bank hereby irrevocably and unconditionally guarantee that the supplier shall perform in an orderly manner their contractual obligations in accordance with the terms and conditions set forth in the Purchase order dated ..... and in the event of the supplier's failure to do so, the Bank unconditionally pay to the MNIT, Jaipur on demand, any amount up to the value mentioned in Clause 3.1 above without any reference to the supplier and without questioning the claim.

3.3 The guarantee herein shall remain in full force for a period of two months beyond the warranty period from the date of certification by the MNIT, Jaipur of successful installation and commissioning of the equipment/ service contracted. Date of start of warranty period will be notified by MNIT, Jaipur to the Bank.

3.4 The decision of the MNIT, Jaipur regarding the liability of the Bank under the guarantee and the amount payable there under shall be final and conclusive and binding on us without

question. The Bank shall pay forthwith the amount demanded by the MNIT, Jaipur not withstanding any dispute, if any, between the MNIT, Jaipur and the supplier.

- 3.5 The Bank further agrees that the guarantee herein shall remain in full force during the pendency of aforesaid period mentioned in Clause 3.3 above and also any extension of the guarantee which has been provided by the Bank for this purpose beyond the aforesaid period provided, further, that if any claim accrues or against the Bank by virtue of this guarantee, should be lodged with us within a period of 60 days from the date of expiry of the guarantee period.
- 3.6 This Guarantee shall not be affected by any change in constitution of the supplier, MNIT, Jaipur or us not shall it be affected by any change in constitution or by any amalgamation or absorption or reconstruction thereof otherwise, but will ensure for and be available to and endorsable by the absorbing amalgamated company or concern.
- 3.7 The MNIT, Jaipur has the fullest liberty without affecting the guarantee to postpone at any time or from time any of the powers exercisable by it against the supplier, either to enforce or forbear the clause governing guarantee in the terms and conditions of the said contract and Bank shall not be released from its liabilities under the guarantee by any matter referred to or by reason of time being given to the supplier or any other forbearance, act or omission on the part of the MNIT, Jaipur or any material or things whatsoever which under the law relating to sureties shall but for the provisions hereof have the effect of so releasing the Bank from its liabilities.
- 3.8 We further agree that the MNIT, Jaipur shall have the fullest liberty without affecting in any way our obligations hereunder with or without our consent or knowledge to vary any of the terms and conditions of the said contract or to extend the time of delivery from time to time.
- 3.9 The Bank undertakes not to revoke this guarantee during its currency except with the previous consent in writing of the MNIT, Jaipur.
- 3.10 We further agree that in order to give full effect to the guarantee herein contained MNIT, Jaipur shall be entitled to act as if we were its principal debtors in respect of its claim against the Supplier hereby guaranteed by us as aforesaid and we hereby expressly waive all our rights of suretyship and other rights if any which are in any way inconsistent with the above provision of this Guarantee.

Notwithstanding anything herein before, liability of the Bank under this guarantee is restricted to Rs. .... (Rupees ..... only) and it will remain in force up to the period specified in Clause 3.3 unless a suit to enforce any claim under the Guarantee is filed against the Bank before the period specified in Clause 3.4. All your rights under this Guarantee shall be forfeited and we shall be relieved and discharged from all liabilities thereunder.

**COUNTERSIGNED**

Signature :	Signature :
Name :	Name :
Designation :	Designation :
Organization :	Organization :

**AFTERSALE SERVICE CERTIFICATE**

From:

-----  
-----

To

The Registrar,  
Malaviya National Institute of Technology (MNIT),  
Jaipur

Whereas, we M/s (Bidder Name) are established & reputable manufacturers (Make of items) of [items name] having service offices at Delhi, Jaipur and in the state of Rajasthan. Details are as under:

-----  
Sr.No.      Address of Service Centre      Phone No.      Number of Engineers

1.

2.

3.

-----  
 We do hereby confirm that:

Services including repair/replacement of defective parts will be done by us. Replacement of defective Systems/parts will be done by equivalent or better systems/parts of the same make. We will attend all the complaints/service calls within 24 working hours and not beyond 5 working days. Down time will not exceed beyond 5 working days. In case, down time exceed 5 working days then we will extend the warranty period of that item(s) double of the down time.

(Signature)

Name :

Designation :

(Head or Senior Executive of Firm)

Address :

Phone No :

Fax No:

Mobile No :

Sr. No.	Name of Equipment	Detailed Specifications	Qty.
1.	<p><b>Kit for Studying characteristics of different types of power semiconductor devices like, MOSFET, IGBT, SCR, TRIAC, and DIAC, etc.</b></p> <p>Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Study of IGBT, MOSFET, SCR, TRIAC, DIAC Devices;</li> <li>2. Study of IGBT V-I Characteristic and Transfer Characteristic;</li> <li>3. Study of MOSFET V-I Characteristic and Transfer Characteristic;</li> <li>4. Study of SCR V-I Characteristic;</li> <li>5. Study of TRIAC V-I Characteristic in both 1<sup>st</sup> &amp; 3<sup>rd</sup> quadrants.</li> </ol>	<ul style="list-style-type: none"> <li>➤ The experimental module consist all general-purpose semiconductor devices with an arrangement to study their characteristics.</li> <li>➤ Further, issues related to high frequency switching of MOSFET and IGBT (switching characteristics) are studied.</li> <li>➤ PWM pulse generator in range of 5 kHz or higher, stray inductance, and snubber circuit on kit/board provided.</li> <li>➤ The experimental kit is capable of working with 230 V, 50 Hz, AC supply and other low power supplies required for the operation is derived internally.</li> <li>➤ The given module also incorporates necessary power supplies of (12V &amp; 40V DC, 30V AC) or equivalent, and measuring instruments for deriving the characteristics.</li> <li>➤ Proper isolation between control and power circuit should be provided.</li> </ul>	2
2.	<p><b>Kit for Studying gate or base drive circuit for various power semiconductor devices like MOSFET or SCR or both.</b></p> <p>Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Study of DC triggering circuit for SCR;</li> <li>2. Study of R triggering circuit for SCR,</li> <li>3. Study of R-C triggering circuit for SCR;</li> <li>4. Study of UJT triggering circuits for SCR;</li> <li>5. Study of Microcontroller based triggering circuit; and</li> <li>6. Study of PWM triggering circuit,</li> <li>7. Study of Optically isolated triggering circuit.</li> </ol>	<ul style="list-style-type: none"> <li>➤ Different types of triggering circuits for latching devices like SCR and other provided.</li> <li>➤ Triggering circuits for voltage-controlled devices with electrical isolation provided.</li> <li>➤ Oscillator with switching frequency upto 5 kHz, PWM circuit, and optical isolation using IC like 6N 137 also provided.</li> <li>➤ Analogue, as well as digital implementation of gate or base drive circuit is demonstrated.</li> <li>➤ Both triggering circuit and a small rated power circuit are provided for experimentation.</li> <li>➤ Power circuit of SCR working with 30 V AC supply or equivalent with resistive load arrangement.</li> <li>➤ Power circuit of MOSFET working with 20 V DC supply or equivalent with resistive load arrangement.</li> <li>➤ The experimental kit operates directly with 230 V 50 Hz AC supply.</li> <li>➤ Proper isolation between control and power circuit should be provided with necessary equipment which ever required for smooth operation of experiment.</li> </ul>	2
3.	<p><b>Kit for study and evaluate the performance of Single Phase Rectifier (AC-DC).</b></p> <p>Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Single-phase half-wave uncontrolled rectifier with different types of load.</li> <li>2. Single-phase full-wave uncontrolled rectifier with different types of load.</li> <li>3. Single-phase half-wave controlled rectifier with different types of load.</li> <li>4. Single-phase full-wave controlled rectifier with different types of load.</li> </ol>	<ul style="list-style-type: none"> <li>➤ Both controlled (SCR based), as well as uncontrolled (Diode based) rectification is available for performance investigation.</li> <li>➤ Various experimentation on single-phase rectifiers with an output ports for observing current waveform on DSO.</li> <li>➤ The experimental kit also includes step-down power supply, control circuit, power circuit, and different types of loads.</li> <li>➤ The module typically operates with 230 V, 50 Hz, AC supply and other low power supplies required for the operation is derived internally.</li> <li>➤ Step down supply voltage with load resistance and load inductance with their combination</li> </ul>	1

	<p>5. Single-phase full-wave half-controlled rectifier with different types of load.</p> <p>6. Single-phase SCR gate pulse and other control signals.</p>	<p>should be provided.</p> <ul style="list-style-type: none"> <li>➤ Proper isolation between control and power circuit should be provided with necessary equipment which ever required for smooth operation of experiment.</li> <li>➤ Freewheeling diode should be provided to provide path to the trapped energy in case of R-L load.</li> </ul>	
4.	<p><b>Kit for study and investigate the operation of Three Phase Rectifier (AC-DC).</b></p> <p>Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Three-phase half-wave uncontrolled rectifier with different types of load;</li> <li>2. Three-phase full-wave uncontrolled rectifier with different types of load;</li> <li>3. Three-phase half-wave controlled rectifier with different types of load;</li> <li>4. Three-phase full-wave controlled rectifier with different types of load;</li> <li>5. Three-phase semi-converter with different types of load; and</li> <li>6. Three-phase SCR's gate pulse generation and other control signals.</li> </ol>	<ul style="list-style-type: none"> <li>➤ Both controlled (SCR based), as well as uncontrolled (Diode based) rectification is available for performance investigation.</li> <li>➤ Various experimentation on three-phase rectifiers with an output ports to display current waveforms on DSO.</li> <li>➤ The experimental module consist step-down power supply, control circuit, power circuit, and different types of load arrangements.</li> <li>➤ The given experimental kit operates effectively with 415 V, 50 Hz, AC supply.</li> <li>➤ Step-down three-phase supply voltage with load resistance and load inductance with their combination should be provided.</li> <li>➤ Proper isolation between control and power circuit should be provided with necessary equipment which ever required for smooth operation of experiment.</li> </ul>	1
5.	<p><b>Kit to test the performance of DC-DC Chopper and understand the difference between DC-DC chopper and DC-DC converter.</b></p> <p>Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Study of different chopper controlling methods;</li> <li>2. Study of gate pulses require for Class-A, Class-B, Class-C1, Class-C2, Class D, and other four types of Class E;</li> <li>3. Study of First quadrant / Type A Chopper with different types of Load.</li> <li>4. Study of two-quadrant chopper with different loads;</li> <li>5. Study of four-quadrant chopper with different loads; and</li> <li>6. Study of step-up chopper with different loads</li> <li>7. Study of regeneration technique with four quadrant chopper.</li> </ol>	<ul style="list-style-type: none"> <li>➤ Various chopper configurations with a provision of observing current waveforms on DSO is integrated in the experimental module.</li> <li>➤ The experimental kit typically includes step-down power supply, control circuit, power circuit, and different types of load arrangements.</li> <li>➤ The kit works with 230 V, 50 Hz, AC supply and other low power supplies required for the operation are derived internally.</li> <li>➤ Proper isolation between control and power circuit is provided.</li> <li>➤ Loading arrangements for experimentation as a part of kit with R Load and R-L Load are provided.</li> <li>➤ Step-down supply voltage with load resistance and load inductance with their combination should be provided in accordance with experiment successful operation.</li> <li>➤ Moreover, significant battery is provided for demonstrating regeneration mode.</li> <li>➤ Microcontroller based control circuit with LCD and keyboard interfacing is provided for selecting different operating modes.</li> </ul>	1
6.	<p><b>Kit to study and analyze the performance of Single-phase AC Voltage regulator.</b></p> <p>Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Study of AC voltage controller controlling methods;</li> <li>2. Study of gate pulses generation for AC voltage controller;</li> </ol>	<ul style="list-style-type: none"> <li>➤ Single-phase AC voltage regulator circuit with provision of performing different experiments.</li> <li>➤ Single-phase half controlled and fully controlled configurations are integrated.</li> <li>➤ TRIAC based controller (application of Fan regulator circuit) section is provided.</li> <li>➤ The experimental module generally includes step-down power supply, control circuit, power</li> </ul>	1

	<p>3. Single-phase half-wave AC Voltage controller with different types of loads;</p> <p>4. Single-phase full-wave AC Voltage controller with different types of loads; and</p> <p>5. Study of TRIAC based controller(Fan regulator circuit) circuit.</p>	<p>circuit and different types of load arrangements.</p> <ul style="list-style-type: none"> <li>➤ Moreover, the kit operates directly with 230V; 50Hz, AC supply.</li> <li>➤ Requisite step down supply voltage with R, R-L combinations should be provided at power level.</li> <li>➤ Proper isolation between control and power circuit should be provided with necessary equipment which ever required for smooth operation of experiment.</li> </ul>	
7.	<p><b>Kit to study and analyze the performance of Three-phase AC Voltage regulator.</b></p> <p>Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Study of gate pulse generation and their control methods;</li> <li>2. Three-phase, four-wire line controlled AC voltage controller with star loads;</li> <li>3. Three- phase AC voltage controller with inside delta controlled loads;</li> <li>4. Study of Three-phase, three-wire line controlled AC voltage controller with star loads; and</li> <li>5. Three phase line controlled AC voltage controller with delta loads.</li> </ol>	<ul style="list-style-type: none"> <li>➤ Three-phase AC voltage regulator with provision of performing various experiments.</li> <li>➤ All possible configurations of three-phase AC voltage regulator are integrated in the module.</li> <li>➤ The module works efficiently with three-phase 440V; 50Hz AC supply and all measuring meters connected externally.</li> <li>➤ Step-down three-phase supply voltage of 30 V AC, three load resistance of order of at least 200 E, and three-phase load inductance of order of at least 120 mH should be provided.</li> <li>➤ Proper isolation between control and power circuit should be provided.</li> <li>➤ Test points for observing intermediate waveforms of gate pulse generation are provided for observation.</li> </ul>	1
8.	<p><b>Kit to study and evaluate the performance of Single Phase Inverter (DC-AC).</b></p> <p>Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Study of single phase half bridge inverter with different types of loads.</li> <li>2. Study of single phase full bridge inverter with different types of loads.</li> <li>3. Study of FFT analysis of square wave inverter;</li> <li>4. Study of Quasi Square Wave (Q.S.W.) inverter;</li> <li>5. Study of Sinusoidal Pulse Width Modulated (SPWM) inverter;</li> <li>6. Study of T.P.W.M.,M.P.W.M., UNIPOLAR &amp; BIPOLAR PWM inverter; and</li> <li>7. Study of Gate pulses for IGBT's in different types of Modes.</li> </ol>	<ul style="list-style-type: none"> <li>➤ Most popularly methods like Square Wave, Quasi Square Wave, Multiple PWM, Trapezoidal PWM, UNIPOLAR &amp; BIPOLAR PWM can be performed.</li> <li>➤ The experimental kit typically composed of step-down power supply, control circuit, power circuit, and different types of load arrangements are provided internally.</li> <li>➤ The module works with 230 V, 50 Hz AC supply and other low power supplies required for the operation are derived internally.</li> <li>➤ Proper isolation between control and power circuit with DC link fuse should be provided with necessary equipment which ever required for smooth operation of experiment.</li> <li>➤ In addition, step-down supply voltage of at-least 24 V DC, load resistance order of 100 E or higher, load inductance 100 mH or higher should be in experiment.</li> <li>➤ Microcontroller based control circuit with LCD and keyboard interfacing is provided for selecting different operating modes.</li> <li>➤ Test points may be arrange.</li> </ul>	1
9.	<p><b>Kit to study and investigate the operation of Three Phase Inverter (DC-AC).</b> Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Study of gate pulses for different control techniques;</li> <li>2. Study of three-phase 120-degree mode inverter with R load / R-L load;</li> <li>3. Study of three-phase 180-degree mode</li> </ol>	<ul style="list-style-type: none"> <li>➤ Most popular controlling methods like 120° mode, 180° mode sinusoidal PWM, square and space vector modulation are experimented.</li> <li>➤ Cortex M4 32-bit Microcontroller based gate pulse generating circuit.</li> <li>➤ The experimental module composed of step-down power supply, control circuit, power circuit and different types of load internally.</li> </ul>	1

	<p>inverter with R load / R-L load;</p> <p>4. Study of FFT analysis of 120/180 degree mode square wave inverter;</p> <p>5. Study of Sinusoidal Pulse Width Modulated (SPWM) inverter; and</p> <p>6. Study of Space Vector modulated (SVM) inverter.</p>	<ul style="list-style-type: none"> <li>➤ The module operates directly with 230 V, 50 Hz AC supply and other low power supplies required for the operation are derived internally.</li> <li>➤ Proper isolation between control and power circuit with DC link fuse should be provided with necessary equipment, test points which ever required for smooth operation of experiment.</li> <li>➤ Step down supply voltage of 24 V DC, load resistance of three-phase 200 E, load inductance three-phase 120 mH are provided or equivalent / higher.</li> </ul>	
10.	<p><b>Kit to study and analyze the performance of Non-Isolated Switch Mode DC-DC Converter.</b></p> <p>Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Study of gate pulse generation circuit for DC-DC converter;</li> <li>2. Study of Buck converter designing;</li> <li>3. Study of Buck converter circuit operation in CCM/DCM modes;</li> <li>4. Study of Boost converter designing;</li> <li>5. Study of Boost converter circuit operation in CCM/DCM modes;</li> <li>6. Study of Buck-Boost converter designing; and</li> <li>7. Study of Buck-Boost converter circuit operation in CCM/DCM modes.</li> </ol>	<ul style="list-style-type: none"> <li>➤ The module demonstrates basis three topologies of DC-DC conversion i.e. Buck, Boost, and Buck-Boost converter.</li> <li>➤ Switching frequency in the range of 40 kHz or equivalent.</li> <li>➤ The module typically includes step-down power supply, control circuit, power circuit and different types of load arrangements.</li> <li>➤ The experimental kit works directly with 230 V, 50 Hz, AC supply.</li> <li>➤ Proper isolation between control and power circuit is provided.</li> <li>➤ Step-down supply voltage with fixed and variable load resistors/ rheostat, inductance of requisite value should be provided. The load values should be strictly match with the experiment need and CCM/ DCM operation requirements.</li> <li>➤ Loading arrangements as a part of trainer and experimentation for continuous current mode (CCM) and discontinuous current mode (DCM) operation are provided.</li> </ul>	1
11.	<p><b>Kit to study and investigate the operation of Single-phase Cycloconverter.</b></p> <p>Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Study of single-phase Cycloconverter gate pulse generating circuit;</li> <li>2. Study of single phase Cycloconverter with R Load; and</li> <li>3. Study of single phase Cycloconverter with R-L Load.</li> </ol>	<ul style="list-style-type: none"> <li>➤ Input: 1-phase supply 230V AC, 50 Hz.</li> <li>➤ Output: 30-35 V, Center-tap transformer of 15-0-15 VAC or suitable for operation of kit.</li> <li>➤ Step-down supply voltage with load resistance and load inductance with their combination should be provided in accordance with experiment successful operation.</li> <li>➤ Modes of operation: f, f/2, f/3, f/4.</li> <li>➤ Firing angle control should be provided with display facility, if possible.</li> <li>➤ Test points: CV, Vsync, VG1, VG2, VG3, VG4 with respect to ground and others as required.</li> <li>➤ Microcontroller based control circuit with LCD and keyboard interfacing is provided.</li> <li>➤ Proper inbuilt isolation between power and control circuit.</li> </ul>	1
12.	<p><b>Kit for study and investigate the performance of Three Phase Diode Clamped Multilevel Inverter.</b></p> <p>Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Study of gate pulse generating</li> </ol>	<ul style="list-style-type: none"> <li>➤ An experimental module with 3-level diode clamped multilevel inverter.</li> <li>➤ Cortex M4 32-bit based Microcontroller for pulse generation or equivalent.</li> <li>➤ Different control technique: <ol style="list-style-type: none"> <li>1. Square wave mode</li> </ol> </li> </ul>	1

	<p>circuit for multilevel inverters;</p> <ol style="list-style-type: none"> <li>2. Study of multilevel inverter in square wave mode with R-load;</li> <li>3. Study of multilevel inverter in square wave mode with R-L load;</li> <li>4. Study of voltage control in multilevel inverter controlled with SPWM inverter;</li> <li>5. Study of voltage control in multilevel inverter controlled with SVM inverter;</li> <li>6. Study of v/f control in multilevel inverter controlled with SPWM inverter;</li> <li>7. Study of v/f control in multilevel inverter controlled with SVM inverter; and</li> <li>8. Comparative study of SPWM and SVM control in multilevel inverter</li> </ol>	<ol style="list-style-type: none"> <li>2. Sinusoidal Pulse Width Modulation (SPWM)</li> <li>3. Space Vector Modulation (SVM)</li> </ol> <ul style="list-style-type: none"> <li>➤ Different mode of control: <ol style="list-style-type: none"> <li>1. Only Voltage control</li> <li>2. Only frequency control</li> <li>3. Voltage – frequency (v/f) control</li> </ol> </li> <li>➤ Input Voltage range: Step-down supply voltage upto 48 V DC or equivalent.</li> <li>➤ Load: Three load resistance in the range of 100 Ω and three-phase inductance having value 120 mH or equivalent. Load values should be compatible with successful operation of experiment.</li> <li>➤ Three current transformers (CTs) are internally integrated to observe the inverter output current waveforms.</li> <li>➤ 12 IGBTs modules or equivalent with proper heat-sink and snubber arrangements.</li> <li>➤ 12 nos. of high speed opto-isolator provided for IGBT PWM inverter.</li> <li>➤ Requisite IGBT gate driver IC provided for IGBT gate driving.</li> <li>➤ One no of input DC power supply for gate driver card.</li> <li>➤ 3 phase outputs and DC input terminals are terminated on the front panel.</li> <li>➤ All are mounted on a nice cabinet with stickered front panel.</li> <li>➤ Proper isolation between control and power circuit is provided with essential test point's facility.</li> </ul>	
13.	<p><b>Kit for analyze and understand the operating principle of 12-pulse Multi-pulse Converter.</b> Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Study of firing pulse generation for 12-pulse converter;</li> <li>2. Study of 12-pulse uncontrolled converter;</li> <li>3. Study 12-pulse controlled converter;</li> <li>4. Study of source voltage waveform of 12-pulse uncontrolled converter;</li> <li>5. Study of source current waveform of 12 Pulse controlled converter; and</li> <li>6. Comparison of supply Power Factor of 6-pulse and 12-pulse converter.</li> </ol>	<ul style="list-style-type: none"> <li>➤ Three-phase 415 V: 30V: 30V, 500 VA (Star – Star / Delta supply Transformer).</li> <li>➤ 12-pulse diode rectifier configuration is composed of 2 numbers of six-pulse diode rectifiers.</li> <li>➤ 12-pulse thyristor rectifier configuration consists of 2 numbers of six pulse thyristor rectifiers.</li> <li>➤ 12-pulse rectifier with provision to study output voltage, transformer secondary currents, and transformer primary current.</li> <li>➤ Firing module - 12 nos. of isolated gate pulses for thyristor converter.</li> <li>➤ Firing angle control: <ol style="list-style-type: none"> <li>1. Potentiometer to vary firing angle in analog mode;</li> <li>2. 8051 controller or equivalent controller to vary firing angle in digital mode.</li> </ol> </li> <li>➤ Necessary test points are provided for intermediate stage control for display.</li> <li>➤ Power circuit – 12 nos. of diode, 12 nos. of SCR with snubber.</li> <li>➤ Proper isolation between control and power circuit is provided.</li> </ul>	1
14.	<p><b>Kit for study the Performance investigation of Single-phase Dual Converter.</b> Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Study of gate pulse generating circuit for dual converters;</li> <li>2. Study of non-circulating mode of</li> </ol>	<ul style="list-style-type: none"> <li>➤ SST89E516RD 8-bit MCU clocked @18.432MHz based Microcontroller with gate pulse generation circuit.</li> <li>➤ Observation of intermediate stage waveforms of gate pulse generation.</li> <li>➤ Selector switch for circulating and non-circulating mode of operation will be provided.</li> </ul>	1



	<p>operation of dual converter with R load;</p> <p>3. Study of circulating mode of operation of dual converter with R load;</p> <p>4. Study of non-circulating mode of operation of dual converter with R-L load; and</p> <p>5. Study of circulating mode of operation of dual converter with R-L load.</p>	<ul style="list-style-type: none"> <li>➤ Experimentation with both R and R-L loads is possible.</li> <li>➤ Firing modules: 8 nos. of isolated gate pulses for positive and negative group of thyristors.</li> <li>➤ Inductors are internally fabricated for circulating current mode operation.</li> <li>➤ Keyboard and LCD display as user interface for adjusting firing angle.</li> <li>➤ One DPDT switch for selection of Dual converter with circulating non-circulating current mode of operation.</li> <li>➤ MCB protection for input power ON/OFF and protection.</li> <li>➤ Potentiometer to vary the firing angle.</li> <li>➤ Proper isolation between control and power circuit is provided.</li> </ul>	
15.	<p><b>Kit to study and test the operation of Isolated DC-DC Converter.</b></p> <p>Following experiments can be performed with this experimental module:</p> <ol style="list-style-type: none"> <li>1. Study of gate pulses of Flyback, Forward, and push-pulls converter;</li> <li>2. Study of Flyback converter designing;</li> <li>3. Study of Flyback converter circuit operation;</li> <li>4. Study of Forward converter designing;</li> <li>5. Study of Forward converter circuit operation;</li> <li>6. Study of push-pull converter designing; and</li> <li>7. Study of push-pull converter circuit operation.</li> </ol>	<ul style="list-style-type: none"> <li>➤ The experimental module typically operates with 230V, 50Hz AC supply.</li> <li>➤ Step-down supply voltage upto 24 V DC and variable load rheostat will be provided for experimentation.</li> <li>➤ Three topologies of isolated DC-DC converters are integrated in the experimental kit: <ol style="list-style-type: none"> <li>1. Flyback converter;</li> <li>2. Forward converter; and</li> <li>3. Push-Pull converter.</li> </ol> </li> <li>➤ Microcontroller based gate pulse generation circuit. <ol style="list-style-type: none"> <li>1. STM32F407VGT MCU @168MHZ;</li> <li>2. Buffered I/O Ports using 74HC573; and</li> <li>3. 2 DAC outputs including all necessary features.</li> </ol> </li> <li>➤ Variable resistive load for open-loop and closed loop control demonstration.</li> <li>➤ Stabilized DC supply 24 V DC or equivalent supply as per strictly suitable for the smooth operation of experiment.</li> </ul>	1
16.	<p><b>Kit of IGBT based SMART Power Module</b></p>	<p>This power module should be generalized and can be used for AC, DC, BLDC, PMSM Motor application by proper external PWM controller interfacing (like Dspic , FPGA &amp; DSP or equivalent).</p> <p>This Module consists of</p> <p>IGBT:- One Number of SPM-Smart Power Module Rating atleast @ 600V/20A Module should have suitable heat sink and snubber circuit for protection, IGBT Power circuit input and outputs are terminated by suitable rating banana connectors in front panel with necessary indication.</p> <p>DIODE RECTIFIER:- One number of diode rectifier ( 600V @ 35A ) is provided to converter input AC voltage to DC Bus voltage with suitable filtering, Analogue DC Voltmeter 600V should be provided to measure DC Bus voltage.</p> <p>PWM ISOLATOR:- Six Number of PWM Isolator</p>	1

		<p>IC (6N137) is used to isolate All the six PWM signals input, One number of +15V@1amp fixed dc power supply is provided for PWM Isolator input side for power excitation, One number of +5V@1amp fixed dc power supply is provided for PWM Isolator Output side power excitation</p> <p>PWM Driver:- Built in IGBT Gate Driver is provided in SPM for IGBT Gate signal amplification</p> <p>SENSORS:- 3 numbers of Hall effect current sensor @ 25A is provided for 3Ø output AC/DC Current measurement, 1 numbers of Hall effect current sensor @ 25A is provided for Input DC bus Current measurement .Op-Amp based Signal conditioner circuits are provided in all sensors for output current signals amplifications, All current sensor signal conditioner circuit outputs are terminated in front panel by suitable connectors</p> <p>PROTECTION CIRCUIT:- One number of automatic trip circuit is provided for O/C protection. LED is provided for trip status indication, Reset switch is provided for TRIP RESET</p> <p>CONNECTORS:- One number of 34 pin FRC Connector is provided for PWM input signal input and feed back, Banana connectors are provided for AC input, Banana connectors are provided for 3 phase output or DC ,Test points are provided for PWM signal and Current wave form measurements, MCB is provided at input side for Input supply ON/OFF</p> <p>Broad Specification: Power Circuit: Input :0-230VAC , 50 HZ (or) 0-300VDC, Output : 3 Ø 230V (Phase voltage) @ 5A , Variable Voltage , Variable frequency ( OR) 0 +/-280VDC, PWM Section, Number of PWM Input :6, Maximum PWM Frequency:15KHZ, PWM Level:0-5V (TTL)</p> <p>Power circuit and control circuit isolation should be provided internally.</p> <p><u>Note : Department already have different type of controller boards and dedicated programs for different motors in different topologies , supplier should supply the power modules . demonstrate and provide training using existing controller boards and motors in department</u></p>	
17.	<b>QEP Interface Card with connector cable</b>	Interface card for interface with a linear or rotary incremental encoder to get position, direction, etc. Compatible for IGBT based SMART Power Module.	<b>1</b>

Deputy Registrar  
(Store & Purchase)