



TENDER DOCUMENTS

Electrical Lab Equipment

NUTECH / SCM / Electrical Lab Eqpt (Ph-IV) 2020 / TD-152

NATIONAL UNIVERSITY OF TECHNOLOGY

TENDER NOTICE

National University of Technology (NUTECH)

NUTECH / SCM / Mechanical Lab Eqpt (Ph-IV) 2020 / TD-151 &

NUTECH / SCM / Electrical Lab Eqpt (Ph-IV) 2020 / TD-152

1. Sealed bids are invited from Government / FBR Registered Firms for the procurement of Lab Equipment for NUTECH on **CPT Basis**.
2. Tender documents containing terms, conditions and detailed specifications of items (including draft contract) can be downloaded from NUTECH website "<https://nutech.edu.pk/downloads/procurement/scm-tenders/> w.e.f **21 August 2020**.
3. Quotations shall be submitted as per requirement of the tender documents.
4. Bidders will be required to submit **Bank Draft / CDR** equal to **5%** of quoted value as Bid Bond in favor of National University of Technology (NUTECH).
5. Submit Rs 1500/- as Tender fee in favor of NUTECH HBL Account (**NUTECH Tendering and Contracts, 5037-7000210755**). Please attach bank receipt with technical offer. Offers will not be entertained without payment of processing fee.
6. Details for Submission & Opening of bids for each tender are as under:-

Ser	Description	Submission	Tender Opening	Completion Days
a.	Mechanical Lab Equipment (TD-151)	1030 hrs on 23 Sep 2020	1100 hrs on 23 Sep 2020	120 Days
a.	Electrical Lab Equipment (TD-152)	1130 hrs on 23 Sep 2020	1200 hrs on 23 Sep 2020	120 Days

Deputy Director (Supply Chain Management)

NATIONAL UNIVERSITY OF TECHNOLOGY, UPROAD, I-12 ISLAMABAD

Tel: 0092-51-5476768, Ext: 227

NATIONAL UNIVERSITY OF TECHNOLOGY
SUPPLY CHAIN MANAGEMENT
INVITATION TO TENDER

Tender submission time: 1130 hours, 23 September 2020

1. NUTECH desires to procure the list of item(s) / Store(s) on **CPT** basis. as per **Annexure-A**. Interested bidders are requested to send their bids through courier or deliver at NUTECH under "Single Stage – Two Envelopes" (two envelopes placed together in third envelope), marked clearly as "**Technical Offer**" and "**Commercial Offer**" respectively to the undersigned, latest by or before above mentioned due date.

2. **Conditions Governing Contracts.** The contract made as result of this IT will be in accordance with the **draft contract published on NUTECH University website** and other special conditions (Mentioned in this document) that may be added to given contract for the supply of Lab Equipment.

3. **Delivery of Tender.** The offer is to be submitted as under:-

a. **Technical Offer.** Technical Offer should contain only Annexure-A, Annexure-A-1 & Annexure B duly filled in (supported with relevant technical literature / details / catalogues etc) and receipt of tender processing fee. Copy of bid bond WITHOUT MENTIONING PRICE should be attached with technical offer. Only relevant technical details i.e literature/brochures) without mentioning the financial aspect of the offer in DUPLICATE should be enclosed in an envelope. In technical proposal, all items must have the brand names, model number, manufacturer's name, country of origin, manufacturer's warranty including parts with complete specs and brochures. Re-conditioned and re-furbished equipment shall not be acceptable. Following information will be clearly marked on the envelope:

- (1) Technical Offer
- (2) Original Performa Invoice (without price)
- (3) Tender number
- (4) Date/ time of opening

b. **Commercial Offer.** Commercial Offer will contain Annexure-C and bid bond (Dully mentioned and placed in separate envelope. The offer indicating the quoted price (IN USD only) in figures as well as in words along would be enclosed in an envelope. Following information will be clearly marked on the envelope.

- (1) Commercial Offer
- (2) Original Performa invoice with price
- (3) Tender number

c. Both the envelopes i.e. commercial offer and technical offer would be enclosed in yet another properly sealed envelope that will be marked with address of this office only. There should be clear indication that this envelope contains tender documents.

d. The tender duly sealed will be addressed to the following:-

Deputy Director (Supply Chain Management Office)
NATIONAL UNIVERSITY OF TECHNOLOGY (NUTECH)
I J P ROAD, I-12 ISLAMABAD
Tel: 0092-51-5476768, Ext: 227

4. **Date and Time for Receipt of Tender.** Sealed bids with detailed specifications should reach SCM office latest by **1130 hours on 23 September 2020**. Delay occurring in post shall not be accepted. Tenders received after the appointed / fixed time will NOT be entertained. The appointed time will, however, fall on next working day in case of closed / forced holiday.

5. **Tender opening.** The offers shall be opened 30 minutes after submission time. Commercial offers will be opened at later stage if Technical Offer is found acceptable on examination by technical authorities. Date and time for opening of commercial offer shall intimated later. Only legitimate / registered representatives of firm will be allowed to attend tender opening.

6. **Validity of Offer.** The validity period of quotations must be indicated and should be 90 days from the date of opening of financial offer.

7. **Documents.** Following information / copy of documents must be provided / attached with offer:-

- a. A copy of letter showing firm's financial capability.
- b. NTN/GST number be mentioned on the offer and copy of registration Certificate issued by Sales Tax Department, attached.
- c. Foreign supplier to provide its Registration Number issued by respective Department of Commerce authorizing export of subject stores.
- d. Annexes A, A-1, B and C and special conditions must be signed and stamped. **ATTACH ONLY RELEVANT DOCUMENTS.**
- e. Complete all Annexes as per given format. Do not use your format or letter head. Offer may be rejected if given format is not followed.
- f. OEM/principal agency agreement must be provided.

8. **Disqualification.** Offers are liable to be rejected if:-

- a. Validity of offer is not quoted as required in IT documents.
- b. Any deviation from the General/ Special / Technical Instructions.
- c. Offers are found conditional or incomplete in any respect.
- d. Copy of EM/Bid Bond & Tender processing fee (with tech offer) and original EM/Bid Bond (with fin offer) are NOT attached.
- e. Multiple rates are quoted against one item.
- f. Manufacturer's relevant brochures and technical details on major equipment assemblies are not attached in support of specifications.
- g. Offer received later than appointed / fixed date and time.
- h. Subject to restriction of export license.
- i. Offers (Commercial / technical) containing non-initialled / unauthenticated amendments / corrections / overwriting. If the validity of the agency agreement has expired. The commercial offer against FOB / CIF / C&F tender quoted in local currency.
- j. If the offer is found to be based on cartel action in connivance with other sources/participants of the tender.

9. **Earnest Money / Bid Bond.** Commercial Offer must be accompanied with a Bid Bond (CDR/Pay Order/Bank Draft) in agreement of faithful compliance of the conditions of Contract. This amount will be equivalent to 5% of the total quoted value. The Bid Bond amount submitted by the successful bidder will however be refunded on effective termination of Contract. (The Bid Bond will be forfeited in case of default by

the bidder from his commitments made through his offer). Submission of Bid Bond is mandatory; otherwise your offer will be rejected. Bid Bond will be used as performance guarantee till the delivery of stores, otherwise separate performance guarantee valued at 5 % of contract will be submitted by successful firm till stores are delivered and inspected.

10. **Return of Earnest Money/Bid Bond.**

- a. Bid Bond to the unsuccessful bidders will be returned on finalization of the lowest evaluated bidder.
- b. Bid Bond of the successful bidder/bidders will be returned on submission of Bank Guarantee/Bid bond against warranty period OR Bid bond retained for the warranty period as the case may be.

11. **Terms of Payment/ LC Charges** In CPT/FOB cases (all categories) payment will be made through letter of credit (LC). LC opening charges in Pakistan are to be borne by NUTECH. Payment will be made through irrevocable LC in favour of Manufacturer. Payment will be in USD.

12. **Bank Guarantee (BG)**.In case where equipment is backed by warranty, the BG submitted equal to 05% of FOB/FOR/CPT etc value shall remain valid for up to 60 days beyond completion of warranty period.

13. **Insurance:-** Insurance will be NUTECH's responsibility through NICL.

14. **Freight charges /Misc charges:** All charges such as packing, forwarding, local freight, loading and unloading, installation and commissioning, custom clearance, orientations, on job training or any other will be part of quoted price. Delivery till NUTECH will be firm's responsibility and all associated costs will be part of quotation as well.

15. **Warranty.** All goods /store offered would be brand new, from current year of production and will be governed as per warranty clause. The warranty period may be covered by BG as depending on the value /criticality of the tender equipment.

16. **Delivery Schedule.** Store will be delivered within **120 Days** from contract signing date.

17. **Force Majeure.** If non-compliance with the period of delivery or services can be proved to be due to Force Majeure, such as but not limited to mobilization, war,

riot, strike, lockout or the occurrence of unforeseen events, the period shall be reasonably extended.

18. **Subletting** Suppliers are not allowed to sublet wholly or part of the contract to any other firm /company without prior permission by NUTECH. Firm found in breach of the clause will be dealt with as per purchaser's right and discretion.

19. **Arbitration.** The dispute shall referred for adjudication to a board comprising of Pro-Rector NUTECH as Chairman and two arbitrators, one to be nominated by each party. The arbitration proceeding shall be held in Pakistan under Pakistan Law. The venue of arbitration shall be the place from which the contract is issued or such other place as the purchaser at his discretion may determine. Arbitration award so given will be firm and final.

20. **Export License/Permit /End User Cert.** It shall be the responsibility of the Supplier to obtain from the Government concerned all permits and export licenses, etc required to enable each consignment to be shipped immediately as per the delivery schedule. In case the supplier fails to arrange export license within 30 days of signing the contract the purchaser reserves the right to cancel the contract on the risk and expense of the supplier without prior notice. The purchaser will provide End User Certificate for acquisition of export license to the supplier (format to be provided by the supplier for respective country within 10 day of signing of the contract).

21. **Technical Specification:** The supplier will provide OEM certificate, quality certificate /inspection document to the purchaser confirming the quality of the product being supplied under this contract .Store must bear the manufacturer's identification marking /monogram.

22. **Inspection /Testing of Store:** Inspection testing will be carried out at NUTECH by the concerned inspection team as detailed by the respective department in accordance with the laid down Acceptance Criteria. (Acceptance Test Procedure (ATPs)/Drawing /Test standard and specification). **The supplier will provide ATPs with technical offer.** Mutually agreed/approved ATPs will form part of contract to govern the inspection of store subsequently.

23. **Requirement of Samples.** The requirement of tender sample will be included in the case if required for evaluation by technical authorities'. Beside this advance sample if required will be also made part of the IT as well as the contract.

24. **Change In Specification / Mfr / Model.** No alternation marked/brand and quality of store will be entertained after the tender have been opened.

25. **Checking of Store at Consignee End.** All stores will be checked at Consignee's end in the presence of the supplier's representative. If for some reason, the supplier decides not to nominate his representative for such checking, an advance written notice to this effect will be given by the supplier to the consignee prior to immediately on shipment of store. In such an event the supplier will clearly undertake that decision of consignee with regard to quantities and description of consignment will be taken as final and discrepancy found will be accordingly made up by supplier. In all other cases the consignee will inform the supplier about arrival of consignment immediately on receipt of store through registered email/letter and telephone. If no response from the supplier is received within 15 days from initiation letter the consignee will have the right to proceed with the checking without supplier's representative .Consignee's report on checking of the stores will be binding on the supplier in such cases.

26. **Packing /Marking.** The supplier shall be responsible for proper packing of the Store in standard export packing worthy of transportation by sea /air /road rail so as to ensure their content being free from lose or damages due to faulty packing on arrival at the ultimate destination. Packing of stores will be done at the expenses of the supplier. All packing cases, containers and other packing material shall become the property of the NUTECH on receipt. Any loss occurred /demurrage paid due to wrong marking will be made good by the supplier

27. **Original Performa Invoice:** Original Performa invoice must have following components incorporated:-

- a. HS Code
- b. Incoterm
- c. Payment Terms
- d. Origin of good
- e. Port of shipment

- f. Address of OEM
- g. Seller acceptance (on Performa Invoice)
- h. Invoice Date
- i. Latest date of shipment
- j. Seller complete bank detail

Note: Performa Invoice in the name of NUTECH in case of FOB cases & in the name of local partner in case of FOR cases.

28. **General Instructions:** Following must be noted:-

- a. The firm should provide point to point acceptance of each clause of IT and special instructions attached with IT.
- b. Firm will render a certificate with technical offer that firm is neither defaulter nor blacklisted by any Government / semi Government organization directly or indirectly.
- c. Rates should be quoted on Free Delivery basis at NUTECH Islamabad.
- d. **2 years** warranty against **5% Bank Guarantee/CDR/Pay Order/ bank Draft** of the store value will be required from the successful bidders from the date of commissioning as performance bond.
- e. The stipulated delivery period should be strictly adhered to. Any anticipated delay that is beyond the control of Seller will be informed (in writing) well in advance of the expiry of the due date of the activity along with reasons thereof, requesting for the grant of extension in delivery period. If the Seller fails to do so, or the Buyer is not convinced with the rationale provided by the Seller, Liquidated Damages up to/at 2% per month or part thereof, will be imposed. However, the maximum limit of the Liquidated Damages will not exceed 10% of the delayed store value.
- f. If even after applicability of 10% LD, the Seller fails to deliver the required stores, the Buyer will be at liberty to Cancel the contract, and /or procure the stores from an alternate source, on the Seller's "Risk & Cost/Expense". In that case, the Seller will be bound to make payment to the new source through NUTECH. The purchaser's decision under this clause shall NOT be subjected to arbitration.
- g. NUTECH reserves the right to cancel the Contract without assigning

any reason whatsoever during its currency / execution / after placement, if the firm is found to be involved in any dubious activity, litigation, lacking to meet contractual obligations with the purchaser or is blacklisted with any other Public procurement agency. No claims / loss / damage of whatsoever nature shall be entertained and NUTECH's decision in this regard will be final / binding on the Seller.

- h. An appropriate amount may be paid for mobilization against Bank Guarantee/CDR/Demand Draft/Pay Order.
- i. Firms with previous pending/outstanding projects/business with NUTECH may not be considered for award of this tender.

Deputy Director
Supply Chain Management Office

Annex-ATechnical SpecificationsNUTECH / SCM / Electrical Lab Eqpt (Ph-IV) 2020 / TD-152

Ser	Part No	Items	Description	A/U	Country of Origin	Qty Req	Bidder Compliance	
							Yes	No
1.		Power Electronics Trainer (Complete Package)	<p>Selenium rectifier Qty. 1 Rated alternated voltage: 30 Vrms Rated continuous voltage: 24 Vav Rated continuous current: 10 Aav</p> <p>Silicon diode Qty. 4 Direct average current: IFAV = 12 A max. Direct non repetitive overload current: IFSM = 75 A (tp = 10 ms) Repetitive peak reverse voltage: URRM = 1000 V Recovery reverse time: trr = 65 ns max.</p> <p>Group of diodes Qty. 1 Six fast acting silicon diodes with RCD protection network suitable for realizing non-controlled rectifying circuits. Direct average current: IFAV = 12 A Direct non repetitive overload current: IFSM = 75 A (tp = 10 ms) Repetitive peak reverse voltage: URRM = 1000 V Recovery reverse time: trr = 65 ns max.</p> <p>SCR Qty. 1 Direct average current: ITAV = 7.6 A max. True RMS value of the direct current: ITRMS = 12 A</p>	No	European/ USA	2		

		<p>Max. repetitive reverse voltage: URRM = 800 V Trigger current: IGT = 15 mA max. Trigger voltage:</p> <p>Group of SCR Qty. 2 Six silicon controlled rectifiers with RCD protection network used for realizing controlled rectifiers and inverters. Direct average current: ITAV = 7.6 A max. True RMS value of the direct current: ITRMS = 12 A Max. repetitive reverse voltage: URRM = 800 V Trigger current: IGT = 15 mA max. Trigger voltage: UGT = 1.5 V max. I2t = 72 A2s</p> <p>Triac Qty. 1 Bidirectional thyristor used for the control in alternated current. Complete with RC suppressor network. True RMS value of the direct current: ITAV = 8 A max. Non-repetitive peak current: ITSM = 70 A, 50Hz (77A, 60Hz) Max. repetitive reverse voltage: UDRM = 800 V Trigger current: IGT = 25 mA max. (all the quadrants) Trigger voltage: UGT = 2.5 V max. State keeping current: IH = 25 mA max. I2t = 24 A2s</p> <p>MOSFET Qty. 1 N-channel enhancement mode power MOS with integrated reverse diode (FRED, Fast Recovery Epitaxial Diode) used as very fast switch in switching</p>				
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			<p>regulators and inverters. Drain-source voltage: $U_{DS} = 400 \text{ V}$ Continuous drain current: $I_D = 10 \text{ A}$ Drain-source on-state resistance: $R_{DS(on)} = 0.55 \Omega$ Gate-source voltage: $U_{GS} = \pm 20 \text{ V}$</p> <p>IGBT Qty. 2 N-channel Insulated Gate Bipolar Transistor (IGBT) with anti parallel hyper fast protection diode used as very fast switch in switching regulators and inverters. Collector-emitter voltage: $U_{CES} = 600 \text{ V}$ Continuous collector current: $I_c = 24 \text{ A}$ at $T_c = 25^\circ\text{C}$ Collector-emitter saturation voltage: $U_{CEsat} = 1.8 \text{ V}_{typ}$ at $I_c = 15 \text{ A}$ Gate-emitter voltage: $U_{GE} = \pm 20 \text{ V}$</p> <p>Group of IGBT Qty. 1 4 N-channel Insulated Gate Bipolar Transistors (IGBT) with anti parallel hyper fast protection diode used as very fast switches in switching regulators and inverters. Collector-emitter voltage: $U_{CES} = 600 \text{ V}$ Continuous collector current: $I_c = 24 \text{ A}$ at $T_c = 25^\circ\text{C}$ Collector-emitter saturation voltage: $U_{CEsat} = 1.8 \text{ V}_{typ}$ at $I_c = 15 \text{ A}$ Gate-emitter voltage: $U_{GE} = \pm 20 \text{ V}$</p> <p>Bridge three phase rectifier Qty. 1 Non-controlled three-phase rectifier in six pulse bridge connection B6UK for the generation of a DC voltage from a three phase mains.</p>				
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		<p>Rated alternating input voltage: $U_{VN} = 400 \text{ V}$ Direct output voltage: $U_d = 540 \text{ V}$ Rated direct current: $I_{dN} = 10 \text{ A}$ Surge forward current: $I_{FSM} = 300 \text{ A}$ $I_{2t} = 400 \text{ A}^2\text{s}$ Voltage drop: $U_F = 1 \text{ V}$ per diode SCR with turn off circuit Qty. 1 Main SCR and auxiliary SCR, complete with RC uppressor circuit. Direct average current: $I_{TAV} = 13 \text{ A}$ max. Max. repetitive reverse voltage: $U_{DRM} = 800 \text{ V}$ $t_q = 35 \text{ ms}$ Block diodes and flywheel, complete with RC suppressor circuit. Max. repetitive reverse voltage: $U_{DRM} = 600 \text{ V}$ $I_{AV} = 8 \text{ A}$ Turn off capacitor: $C = 2 \mu\text{F}$ Oscillation coil: $L = 1 \text{ mH}$ Shunt for the measurement of the currents in each branch: $4 \times 0.1 \Omega$ DC Power Supply Qty. 1 Laboratory power supply with two fixed voltage outputs and protected against short-circuit. Output voltages: $+15 \text{ V}$; 0 V ; -15 V Output current: $2,4 \text{ A}$ (3 A for a short period) Power supply: single-phase from mains Two led ($+15 \text{ V}$; -15 V) for the indication of the nominal voltage. Mains switch with pilot lamp Voltage Reference Generator Qty. 1 Power supply: $+15 \text{ V}$; 0 V ; -15 V Range of the continuous regulation reference signal:</p>					
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		<p>from - 10 V to + 10 V, from 0 to + 10 V Range of the step reference signal: from - 10 V to + 10 V, from 0 to + 10 V Switch for selecting between internal potentiometer reference signal and external reference signal Switch for selecting between the 0 / ±10 V range and the 0 /+10 V range Trigger point limiter Qty. 1 Stability limit for rectifier: 0° to 180° Stability limit for inverter: 180° to 0° Power supply: +15 V / 0 V / - 15 V Two pulse control unit Qty. 1 Power supply: +15V/ 0V / - 15V (25mA) Synchronization voltage: 1 to 440 V Control voltage U_c: 0 V to 10 V Trigger angle: 180° to 0° Number of outputs: 2 x 2 Possibility of pulse train or single pulse. Possibility of selecting two natural switching points: 0° and 30°. Inhibit voltage: U_{INH} = 15 V (open): trigger pulses. U_{INH} = 0 V: no trigger pulses. Six pulse control unit Qty. 1 Power supply: +15V/0V/- 15V (300mA) Synchronization voltage: 1 to 440 V Analogue control voltage U_c: 0 to 10V Digital TTL control: DWH = FH...FFH (15...255)10 Trigger angle: 180° to 0°(300°...120°/60°...240°) Number of outputs: 3 x 2 Possibility of pulse train or single pulse. Possibility of excluding the secondary pulse. Possibility of selecting three natural switching</p>					
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			<p>points: 0°, 30° and 60°.</p> <p>Inhibit voltage: UINH = 15 V (open): trigger pulses. UINH = 0 V: no trigger pulses</p> <p>PWM, PFM, TPC control unit Qty. 1</p> <p>Power supply: +15V/0V/- 15V (600 mA) Control voltage: Uc: 0 to 10V PWM: 20-200 Hz/0.2-2 kHz/2-20 kHz Duty cycle D = ton/T = 0-0.95 PFM: 5-50 ms/50-500 ms/0.5-5 s Frequency: 20 Hz to 20 kHz TPC: Hysteresis: UH = 0 to 2 V Number of outputs: 2 x 2, with led indication of the status Output amplifier: threshold voltage 5 V, short-circuit proof</p> <p>Inhibit voltage: UINH = 15 V (open): trigger pulses. UINH = 0 V: longer pulses at certain outputs only.</p> <p>Run-up control unit Qty. 1</p> <p>Power supply: -15 V/0 V/ 15 V Input signal range: Ui = -10 V ... 10 V Fine adjustment of the slew-rate: 0.5 . . . 50 V/s Fine adjustment of the voltage gain: 0.1 . . . 1 Inhibit voltage: UINH = 0 V: zero output voltage U0 and output UINH = 15 V UINH = 15 V (open): output voltage U0 runs up and output UINH = 0 V</p> <p>PID Controller Qty. 1</p> <p>Standard industrial controller that can be used as P, PI, PD or PID controller in the closed loop automatic control systems.</p>				
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		<p>Power supply: +15 V ; 0 V ; -15 V Input summing node for two different reference variables UR and UC and for one controlled variable UA. Signal voltage range: -10V ... +10V Parameters of the controller continuously adjustable Proportional gain: $K_p = 0 \dots 1000$ Time of the integral action: $T_I = 1\text{ms} \dots 100\text{s}$ Time of the derivative action: $T_D = 0.2\text{ms} \dots 20\text{s}$ Reset input of the integral controller. Output summing node to add or subtract noise variables. Measurement terminal for the error signal. Adjustment screw for the output offset. Three led indicator of the sense of deviation. Coarse and fine adjustment of the proportional gain K_p, of the time of the integral action T_I and of the time of the derivative action T_D. Indicator of over-range: led "over" on when the output voltage is higher than 10 V or lower than -10 V. Input loff for resetting the I controller.</p> <p>Absolute value generator Qty. 1 Power supply: -15 V/0 V/+15 V Input signal range U_i: -10 V . . . + 10 V Adjustable gain: 0 . . . 1 Inverting control input: $U_{INV} = 0 \text{ V}$: the input signal is inverted $U_{INV} = 15 \text{ V}$ or disconnected: the input signal is not inverted Inhibit voltage: $U_{INH} = 0 \text{ V}$: the output signal is zero $U_{INH} = 15 \text{ V}$ (open): the absolute value circuit is active</p>					
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		<p>Adaptive PI controller Qty. 1 Double compact PI controller for use as current controller in dc servo drives. Power supply: -15 V/0 V/+15 V Input summing point for two different reference variables URand UC and one controlled variable UA. Signal voltage range: -10 V . . . + 10 V Continuously adjustable parameters of the two controllers: proportional gain $K_p = 0 \dots 1000$ integral action time $T_I = 0.2 \text{ ms} \dots 20 \text{ s}$ Integral element reset by switch or via external signal. Regulator selection by switch or via external signal.</p> <p>Gain and Offset Adjust Qty. 1 Power supply: +15 V ; 0 V ; -15 V Voltage interval of the input signal: -50 V, ..., +50 V Adjustable level through the setting of the gain: 01, 0 10, 0 100 Attenuation of the pulse signals. Time constants: 0,1 10 ms ; 10 100 ms Offset voltages that can be connected: -10 V +10 V Coarse setting through rotary switches. Potentiometer fine setting.</p> <p>Mains transformers Qty. 1 Three-phase transformer able to supply single and three phase voltages as well as a rectified voltage for the excitation of the dc machines. Three pilot lamps for signaling the mains voltage.</p>					
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		<p>AC output through isolation transformer: 3 x 90 V/1.5 A with 3 intermediate sockets at 45 Vac. DC output, non isolated from mains: 1 x 220 V/1 A, switch with pilot lamp and magneto-thermal protection 1 A</p> <p>Capacitors Qty. 1 Two electrolytic high performance capacitors. Rated value: 2 x 1000 μF Rated voltage: 385 V Protection against polarity inversion. Discharge resistance: 330 kΩ (t = 330 s)</p> <p>Super-fast fuses Qty. 2 Nominal voltage: 660 Vac Nominal current: 3 x 6.3 A and 3 x 10 A</p> <p>Switching transformer Qty. 1 Ferrite core N27 without air gap. Primary: 2 x 115 V, 2 x 48 turns Thermal protection: 2 x 0.6 A Secondary: 2 x 15 V/ 4.5 A, 2 x 7 turns Inter-winding shield. Rated power: 135 VA Rated frequency: 15 kHz</p> <p>Current transformer Qty. 1 For potential-free measurements of ac currents in single and three-phase without neutral. Current: 10 A Unsmoothed output voltage for synchronization. Smoothed output voltage for current regulator. Transformation ratio: 2 V / 1 A and Insulation voltage: 3 kV</p> <p>Trigger pulse switch Qty. 1 For switching the trigger pulses from the control unit to double converters in 4-quadrant systems. Two pulse inputs and Two control inputs. Eight electrically isolated pulse outputs and Power supply: +15 V</p>					
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		<p>Switching logic Qty. 1 Input Xn for torque comparator (speed set point value). Input Xi for current comparator with adjustable limit threshold. Output SA and SB for the corresponding inputs of the trigger pulse switch with led indication of the active converter. Output INV for the corresponding inverting input of the absolute value generator. Output INH for the corresponding inhibit input of the two pulse control unit, with adjustable delay time from 10 ms to 2 s and led indication of the commutating time. Current comparator output C for EXT selection input of the active elements of the adaptive PI controller. Power supply: +15 V/0 V/-15 V</p> <p>Function generator Qty. 1 Functions: sine / triangle / square wave / square wave with variable duty cycle. Frequency range: 10 Hz . . . 100 kHz in 4 decades. Output voltage: 0 V to 20 Vpp adjustable Two additional outputs with attenuator: -20 dB/ -40 dB TTL output for triggering. VCO input, AC coupled. Power supply: single-phase from mains</p> <p>Voltage divider 20:1 Qty. 1 Electronic voltage divider used as an interface between the dc machines (200 V) and the automatic control circuits (-10 V ...+15 V). Possibility of capacitive filter with time constant</p>					
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			<p>0.1 s. Protection against over voltages up to 1000 Vdc. Power supply: +15 V / 0 V / - 15 V Universal Load Qty. 1 Ohmic, inductive and capacitive load suitable for the experiments in the power electronics laboratory. a) Load resistors: 3 x 100 Ω/1 A and Protection with fuses: 3 x T1.25 A Possibility of connecting in series (300 Ω), in parallel (33.33 Ω) or in star and delta b) Load inductors: 2 x (12.5 - 50) mH/2.5 A Possibility of connecting in series (100 mH) and in parallel (6.25 mH). c) Load capacitors: 4-8-16 μF/450 Vac Possibility of connecting in parallel (28 μF). Discharge resistor: 1 kΩ/0.22 A Socket with lamps Qty. 1 Three lamp-holders E14. Complete with three incandescent lamps: 40 W/220 V. Possibility of connecting in parallel. Stabilized power supply Qty. 1 The power supply has two sections: Regulated variable voltage section, used to supply the armature of dc motors. Output: 0 ÷ 240 Vdc, 5 A Drive: manual or external via 0 ÷ 10 Vdc signal Constant voltage section, used to supply the excitation circuit of dc machines. Output: 220 Vdc, 1 A Phase control fault simulator Qty. 1 Double time-constant standard light dimmer circuit consisting of triac, diac, two control potentiometers,</p>					
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		<p>resistors and capacitors. A total of 20 faults can be switched on using switches located behind a cover.</p> <p>Typical faults: interruptions, short-circuit, faulty components and faulty design.</p> <p>Power supply: 110 to 230 V, 47-63 Hz</p> <p>Ohmic load: 1.2 kW max</p> <p>EMI Filter Qty. 1</p> <p>Inductances on the line: 0.4 mH</p> <p>Capacitors between conductors and neutral: 100 nF</p> <p>Capacitor between neutral and ground: 22 nF</p> <p>Isolation amplifier Qty. 1</p> <p>Isolation amplifier, channels A, B, C, E:</p> <ul style="list-style-type: none"> - Frequency range: dc to 80 kHz. - Max Input voltage: Max 620 Vdc/460 Vac <p>Input resistance $R_i = 1 \text{ MW}$ in all ranges</p> <ul style="list-style-type: none"> - Input current (between 0 and I) Max: 10 A continuous; 16 A for $t < 15 \text{ min}$; 20 A for $t < 2 \text{ min}$. <p>Internal resistance: 30 mW in all ranges</p> <p>Five outputs: A, B, C, D, E with led for over range</p> <p>Indication Output resistance $R_O: 100 \text{ W}$</p> <ul style="list-style-type: none"> - Multiplexer: <p>Mux channels, selectable: 1 to 8 (4 x signal; 4 x zero line) Gain attenuator, adjustable: 0.2 to 1.</p> <p>Y-position, adjustable: -8 V to + 8 V.</p> <p>Mux frequency, adjustable: 50 kHz to 500 kHz (typical).</p> <p>Two BNC outputs for oscilloscope</p> <p>Mathematical module and filter:</p> <ul style="list-style-type: none"> - Functional modes for channel D: Addition A+B; subtraction AB; multiplication $A \times B / 10$ or $A \times B$; reconstruction of the phase voltage LIN(A, B, C) from the line-to line 					
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		<p>voltages; channel E switched into channel D for multiplexing.</p> <ul style="list-style-type: none"> - Filter <p>Low pass active filter of the 2° order required for the recovery of the fundamental wave out of the PWM signals.</p> <p>Cut-off frequency: 1 kHz.</p> <p>Space vector indicator:</p> <ul style="list-style-type: none"> - Voltage vector: indication with 7 led. - Magnetic flux vector: BNC outputs X e Y for oscilloscope. <p>Power supply:</p> <ul style="list-style-type: none"> - Single-phase from mains Frequency: 50/60 Hz. <p>Support with 3 shunts 1 ohm</p> <p>Support with 3 shunts, with different connection possibilities.</p> <p>Resistance: 1 Ω ; Accuracy: $\pm 1\%$; Max. current: 2.5 A</p> <p>Support with 3 shunts 0.1 ohm Qty. 1</p> <p>Support with 3 shunts, with different connection possibilities.</p> <p>Resistance: 0.1 Ω ; Accuracy: $\pm 1\%$; Max. current: 8 A</p> <p>Frequency converter Qty. 1</p> <p>Transistor pulse-converter with pulse driven voltage source inverter and transistor for the generation of a three-phase, variable frequency and variable voltage system. In conjunction with the PWM control unit this device is used for the realization of a frequency converter for asynchronous motor drive.</p> <p>Output voltage: 3 x 0...230 V</p> <p>Output current: 3 x 8 A max.</p>					
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			<p>Supply voltages: power circuit, 1 x 255 V max, 50/60 Hz control circuit, single-phase from mains</p> <p>PWM Control Unit Qty. 1 Control unit used in conjunction with the frequency converter to build a voltage-source inverter which operates with PWM control. All of the control, monitoring and measuring functions are integrated into the control unit while the frequency converter contains solely the power components. A PWM modulator controls the power transistors of the inverter and thus generates a sine-shaped motor current. Modulation possibilities: PWM, VVC, trapezium shaped and block type.</p> <p>PC Interface Qty. 1 IN/OUT connector for connection to the control unit and display for the visualization in hexadecimal of the control word. Two AO lines for analogue outputs: ± 10 V. Six AI lines for analogue inputs: ± 10 V The analogue signal is obtained from a D/A converter with 12 bit resolution. Auxiliary relay with led to show the switching status. USB connection.</p> <p>Power Electronics Software Qty. 1 With this software it is possible to measure the wave forms for voltage and current that can be found in the static inverter and converter circuits. Through a microprocessor based interface it is possible to detect the wave forms and to send the controls to obtain trigger angles through</p>					
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		<p>software.</p> <p>On the screen the true RMS value, the mean value, the power and other parameters are calculated in order to allow the evaluation of the efficiency of the different circuits.</p> <p>The software features a very accurate graphic presentation and a user friendly interface with the end user.</p> <p>Induction Motor Control Software Qty. 1</p> <p>With this software it is possible to realize the PWM, VVC, trapezium shaped and block type, full and half frequency control of the frequency converter and to do the acquisition of the mechanical characteristics of the induction motor under testing.</p> <p>Voltages, currents and other main characteristics are calculated both in numbers and as curves.</p> <p>The software features a very accurate graphic presentation and a user friendly interface with the end user.</p> <p>Variable Three Phase Transformer Qty. 1</p> <p>Power supply: three-phase from mains Rated output: 550 VA</p> <p>Secondary phase current: 1.25 A</p> <p>Secondary voltage: 0 to 440 V</p> <p>The voltage is set by means of a variable autotransformer with rotary knob and the output is floating</p> <p>by means of an isolating transformer with subdivided secondary winding.</p> <p>Fitted with mains lamp and motor circuit breaker.</p> <p>Battery stack Qty. 1</p>					
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		<p>Two rechargeable batteries, maintenance free and Capacity: 1.8 Ah/12 V</p> <p>Tachometer Qty. 1 Speed ranges: 1500/3000/6000 rpm Accuracy class: 1.5 Output voltage: 1 V/1000 rpm</p> <p>Single phase supply unit Qty. 1 Power supply: single-phase from mains Cam operated 2-pole mains switch 16 A Automatic circuit breaker: 10 A, operated by thermal effect Output terminals L and N, with pilot lamp Pilot lamp for indication of mains false polarity</p> <p>Three phase supply unit Qty. 1 Power supply unit for three-phase connection with 4-pole cam mains switch. 25 A current operated earth leakage circuit breaker, sensitivity 30 mA. Triple-pole motor protection switch: 6.3 to 10 A. Three-phase indicator lamps. Output through 5 safety terminals: L1, L2, L3, N and PE.</p> <p>Digital AC/DC Multi-range Power meter Qty. 1</p> <ul style="list-style-type: none"> • Automatic Scaling • Current range: 0-20 lac/dc 20 - 100Hz • Voltage range: 0-750 Vac/dc 20 - 100Hz • Power range: 0-1000W, VAR and VA • Accuracy: +/- 0.5% • Resolution: 16bits • Refresh rate : 0.5s • Power supply: 90-260 Vac 50/60Hz • Power consumption: 3 VA • Communication: Modbus (RS485) <p>True rms meter Qty. 2 Voltage:</p>				
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			<p>0 .. 1000V DC 0 .. 1000VACpp 0 .. 750VACrms Current: 0 .. 20 A Continuous overload protection in all ranges. Moving iron voltmeter Qty. 1 Scale: 50 divisions Range: 125-250-500 V Range changeover switch. Moving coil ammeter Qty. 1 Scale: 50 divisions and Range: 2.5 A Asynchronous squirrel cage three phase motor Qty. 1 Squirrel cage three-phase asynchronous induction motor, with three-phase stator winding and squirrel cage buried in the rotor. Rated power: 180 W and Voltage: 380/690 V Δ/Y Slip ring three phase asynchronous motor Qty. 1 Induction motor with both stator and rotor three-phase windings. Power: 250 W ; Voltage: 220/380 V D/Y ; Current: 1.65/0.95 A D/Y Excitation: 92 V, 2 A ; Frequency: 50 Hz ; Cosϕ: 0.66 Speed: 1350 rpm and Thermal protection. Rheostatic rotor Qty. 1 Steps operated starter for three phase induction motor with slip ring rotor. Step resistance value: 3 x (12-6-3-1-0) W Current: 3 x 2.5 A max. Shunt excitation direct current motor Power: 200 W ; Voltage: 220 V ; Current: 1.5 A</p>				
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		<p>Excitation: 200 V, 0.067 A ; Speed: 3000 rpm Thermal protection.</p> <p>Shunt excitation direct current motor Qty. 1 Power: 160 W ; Voltage: 220 V ; Current: 0.73 A Excitation: 220V, 0.075A ; Speed: 2850 rpm Thermal protection</p> <p>Shunt excitation direct current generator Qty. 1 Power: 160 W ; Voltage: 220 V ; Current: 0.73 A Excitation: 220V, 0.075A ; Speed: 2850 rpm Thermal protection.</p> <p>Powder brake Qty. 1 Maximum braking torque: 12 Nm Power: 400 W ; Voltage: 0 ÷ 24 V Speed: 4000 rpm max. and Thermal protection.</p> <p>Load cell Qty. 1 Resistance electronic strain-gauge with 100 N range, to be mounted on the brake unit for measuring the mechanical torque.</p> <p>Powder brake control unit Qty. 1 Speed section: - K2 connector for the speed transducer - Circular scale three-range instrument: 1500/3000/6000 rpm - Analogue output: 1 mV/rpm Torque section - K connector for the torque transducer - Circular scale three-range instrument: 1.5/3/10 Nm - Analogue output: 1 V/Nm Brake control - Output power: 0 to 12 Vdc, 0.5 A - Manual, external or automatic regulation.</p>					
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		<p>Thermal protection with alarm indication and Recorder pen control.</p> <p>Base Qty. 1 Metallic structure, fire varnished, suitable for mounting the machine or the group under test. Complete with optical transducer for rotating speed detection and with anti-vibration rubber feet.</p> <p>Flywheel Qty. 1 Used in deceleration tests on rotating machines for calculation of Mechanical iron and copper losses at different excitations.</p> <p>Stop clock Qty. 1 Stopwatch with LCD display. Measuring range: 9 h, 59 min, 59 s, 99/100 s and Battery: 1.5 V</p> <p>Frame Qty. 2 Metal frame for assembling the modules of the laboratory.</p> <p>Connecting leads Qty. 1 Set of connecting leads of different diameters and lengths.</p> <p>Storage Cabinet Qty. 1</p> <p>Or Equivalent</p> <p><u>Experimental Capabilities</u></p> <p>ALTERNATE CURRENT - DIRECT CURRENT CONVERSION (RECTIFIERS)</p> <p>DIODES AND UNCONTROLLED RECTIFIERS</p> <ul style="list-style-type: none"> • Single pulse rectifier, ohmic load 					
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		<ul style="list-style-type: none"> • Single pulse rectifier, ohmic-inductive load • Two-pulse rectifier, ohmic load • Two-pulse rectifier, ohmic-inductive load • Two-pulse bridge rectifier, ohmic load • Two-pulse bridge rectifier, ohmic-inductive load • Three-pulse rectifier, ohmic load • Three-pulse rectifier, ohmic-inductive load • Six-pulse rectifier, ohmic load • Six-pulse rectifier, ohmic-inductive load • Six-pulse bridge rectifier, ohmic load • Six-pulse bridge rectifier, ohmic-inductive load <p>SCR AND CONTROLLED RECTIFIERS</p> <p>Single pulse converters</p> <ul style="list-style-type: none"> • Single pulse converter, ohmic load • Single pulse converter, inductive load • Single pulse converter, ohmic-inductive load • Single pulse converter, ohmic-inductive load and free-wheeling diode • Single pulse converter, ohmic-inductive load and back e.m.f. • Single pulse rectifier, ohmic-capacitive load • Single pulse converter, ohmic-capacitive load <p>Two-pulse midpoint converters</p> <ul style="list-style-type: none"> • Two-pulse midpoint converter, ohmic load • Two-pulse midpoint converter, ohmic-inductive load <p>Multi-phase converters</p> <ul style="list-style-type: none"> • Three-pulse midpoint converter, ohmic load • Three-pulse midpoint converter, ohmic-inductive load • Six-pulse midpoint converter, ohmic load • Six-pulse midpoint converter, ohmic-inductive load 					
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		<p>Drainage-coil converters</p> <ul style="list-style-type: none"> • Double three-pulse star converter, ohmic load <p>Bridge converters</p> <ul style="list-style-type: none"> • Half-controlled bridge, ohmic load • Half-controlled bridge, ohmic-inductive load • Half-controlled bridge, ohmic load • Half-controlled bridge, ohmic-inductive load • Fully-controlled bridge, ohmic load • Fully-controlled bridge, ohmic-inductive load • Fully-controlled bridge, ohmic load and back e.m.f. • Fully-controlled bridge, dc motor load • Fully-controlled bridge, ohmic load and supplementary dc voltage • Fully-controlled bridge, dc generator load • Three-phase half-controlled bridge, ohmic load • Three-phase fully-controlled bridge, ohmic load • Three-phase fully-controlled bridge, ohmic-inductive load <p>THYRISTORS & CONTROLLED AC/AC CONVERTERS</p> <p>Single-phase controllers</p> <ul style="list-style-type: none"> • Single-phase ac controller, ohmic load • Single-phase ac controller, inductive load • Single-phase ac controller, ohmic-inductive load • Single-phase ac controller, ohmic load • Single-phase ac controller, ohmic-inductive load • Half-controlled single-phase controller, ohmic load <p>Three-phase controllers</p> <ul style="list-style-type: none"> • Fully controlled three-phase controller, star ohmic load without neutral 					
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		<ul style="list-style-type: none"> • Fully controlled three-phase controller, star ohmic load without neutral • Three-phase controller, star ohmic load without neutral <p>LIGHT DIMMER FAULT SIMULATOR Double time-constant standard light dimmer circuit consisting of triac, diac, two control, potentiometers, resistors and capacitors. Examples of exercises:</p> <ul style="list-style-type: none"> • Fault-free dimmer • DIAC shorted • DIAC with high resistance • The gate of TRIAC works like a diode • Control circuit break • Assembly or component fault • Trimmer shorted • Auxiliary RC circuit not included • Variable resistance R shorted • TRIAC shorted <p>DIRECT CURRENT to DIRECT CURRENT CONVERSION(CHOPPERS)</p> <ul style="list-style-type: none"> • Main SCR • MOSFET • IGBT • Step-down converter with SCR with turn-off circuit. PWM control. • Step-down converter with IGBT. PWM control. • Speed control of a dc motor • Step-down converter with MOSFET. PWM control. • Step-down converter with MOSFET. PFM control. • Step-down converter with MOSFET. TPC 					
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		<p>control .</p> <ul style="list-style-type: none"> • Step-up converter with IGBT. PWM control. • Step-up converter with IGBT. TPC control. • Inverting converter with IGBT. PWM control. <p>SWITCHABLE POWER SUPPLY</p> <ul style="list-style-type: none"> • Flyback converter with IGBT. PWM control. • Forward converter with IGBT. PWM control. • Asymmetric half-bridge forward converter with IGBT. PWM control. <p>DIRECT CURRENT - ALTERNATE CURRENT CONVERSION</p> <p>INVERTERS</p> <ul style="list-style-type: none"> • Single-phase full-bridge dc chopper. PWM control. • Single-phase full-bridge inverter. Square-wave PWM control. • Single-phase full-bridge inverter. Sinusoidal PWM control. <p>FREQUENCY CONVERTERS</p> <ul style="list-style-type: none"> • Frequency converter • Input controlled rectifier • Output power inverter <p>MOTOR DRIVES</p> <p>DC MOTOR DRIVE</p> <ul style="list-style-type: none"> • Single-quadrant drive with converter • Single-quadrant drive with converter and armature voltage feedback • Single-quadrant drive with converter and armature voltage feedback with RI compensation • Single-quadrant drive with converter and tacho-voltage feedback • Single-quadrant drive with converter and tacho-voltage feedback with inner current 					
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		<p>loop</p> <ul style="list-style-type: none"> • Two-quadrant drive (I-IV) with converter • Two-quadrant drive (I-III) with converter • Two-quadrant drive (I-III) with converter and tacho-voltage feedback with inner current loop • Four-quadrant drive with converter • Four-quadrant drive with converter and tacho-voltage feedback with inner current loop • Single-quadrant drive with converter • Single-quadrant drive with converter and tacho-voltage feedback with inner current loop <p>AC SLIP-RING MOTOR DRIVE</p> <ul style="list-style-type: none"> • Control of stator voltage with transformer • Control of stator voltage with controller • Control of stator voltage and tacho-voltage feedback • Rotor starter • Rotor pulsed resistor • Rotor pulsed resistor and tacho-voltage feedback • Scherbius static drive • Scherbius static drive and tacho-voltage feedback <p>AC SQUIRREL CAGE MOTOR DRIVE</p> <ul style="list-style-type: none"> • Preliminary investigation of the squirrel cage motor • Six-pulse PAM • Pulsed square-wave triggering • Trapezoidal modulation • Pulse width modulation (PWM) • Voltage vector control (VVC) 					
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			<ul style="list-style-type: none">• Motor magnetization for linear U/f characteristic• Extra start magnetization• IxR compensation• Operation in standard converter setting• Slip compensation• Motor operation in star connection• Brake chopper• Speed control with tacho-voltage feedback					
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Firm Name: _____

Signature: _____

Name: _____

Designation: _____

Annex A-1**Special Instructions**

Description	Bidder			Tech Scrutiny to be done by User		
	Yes	No	Alternate Offer	Accepted	Rejected	Reasons of Rejection
Environment Conditions (a) Temperature range: 05°C to +60°C (b) Relative humidity: 0-70% non-condensing						
Warranty period Two years from the date of commissioning. A warranty sticker is to be pasted on each imported item by the Supplier / OEM highlighting Name of Firm, Contract No and date, Description of Store and Warranty validity						
Training Notes Supplier will provide a set of handouts for training on operation and maintenance of the equipment						
Publications Supplier is to provide hard and soft copies (CD) of following manuals. (a) Operational / Maintenance manual: - Qty 01 with Equipment and additional Qty 02 for record purposes and should consist of following sections:- (1) Equipment Description /Operation:- (a)Specifications (b)Description (c)Operation (2) Servicing:- (a)Maintenance Schedule (b)Adjustment / test (c)Removal / Installation procedure (d)Tools Used (3) Trouble shooting guide (4) Cleaning requirements (5) Shipping and receiving (6) Storage requirements						

<p>(b) IPB (Illustrated Parts Breakdown Manual) should have full parts description along with detailed diagrams (exploded view).</p> <p>(c) Experimental manuals which must contain the list and procedure of the experiments that equipment can perform.</p> <p>(d) Recorded video lectures of the equipment explaining use/functions/experiments.</p>					
<p>Spares / Technical Support</p> <p>(a) Supplier to have in-country spares / technical support and ensure spares and technical support / assistance for next 10 years</p> <p>(b) Comprehensive list of spares required for scheduled maintenance of Equipment is to be provided</p> <p>(c) Any software provided must have its licenses</p> <p>(d) Software upgrade support must be provided free of cost for 10 x years with renewed license at every upgrade</p> <p>(e) Supplier must also provide calibration service for at least 5 x years after commissioning</p>					
<p>Additional Spare / Replaceable parts.</p> <p>(a) Replaceable spare / parts during scheduled inspections are to be identified and provided as per requirement along with equipment sufficient to cater five years consumption.</p> <p>(b) All specialized / standard tools required for inspection / repair / servicing must be supplied along with equipment.</p>					
<p>Physical Inspection Criteria: 100% physical inspection of store will be carried out before commissioning of the equipment for following details:-</p> <p>(a) For physical damage, scratches and deformity.</p> <p>(b) Accessories /components as per contractual specifications.</p>					

<p>(c) Technical Manuals (Operation manual, user guide, IPBs).</p> <p>(d) Quality certificate and calibration certificate by the OEM</p> <p>(e) OEM certificate and verifiable documents by the supplier that store has been procured from certified source and is factory new and from latest production.</p> <p>(f) Brand name and country of origin.</p>						
<p>Commissioning</p> <p>(a) Commissioning of the equipment will be carried out by OEM rep at his own cost and risk at designated place at NUTECH.</p> <p>(b) Any special requirement for installation, operation and commissioning must be specified in the offer by the supplier.</p>						
<p><u>Training Required:</u> 01 week OEM operational/ maintenance training at NUTECH. Approximately 15 personnel of NUTECH faculty members at NUTECH Labs without any additional cost</p>						
<p>Improvement and Safety Measures: Any improvement and safety measures suggested by NUTECH during commissioning are to be resolved by the supplier / manufacturer at no extra cost.</p>						
<p>Liability of Supplier</p> <p>(a) OEM certificate of authorized dealership Supplier is to provide original OEM certificate of subject equipment bought directly from the manufacturer and being an authorized dealer.</p> <p>(b) Incase the equipment supplied is not compatible with specifications, the supplier will be obliged to call his representatives at his own cost for consultation and corrective action</p>						

<p>Special Notes</p> <p>(a) Additional requirements for the maintenance of equipment (if any) must be intimated by the supplier in technical offer.</p> <p>(b) Supplier must provide the list of organizations using same equipment in Pakistan (if any).</p> <p>(c) Equipment must be a standard product of OEM available at web address of OEM.</p> <p>(d) In case of premature failure of the equipment, OEM has to replace / rectify the item free of cost. Required transportation charges would be borne by the supplier.</p>						
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<p>Firm Name: _____</p> <p>Signature: _____</p> <p>Name: _____</p> <p>Designation: _____</p>
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Annex-B

TECHNICAL OFFER

NUTECH / SCM / Electrical Lab Eqpt (Ph-IV) 2020 / TD-152

Fill in following essential parameters:-

1. Validity of Offer: _____ Days (Should not be less than **120 days**)
2. Delivery period: _____ Days (After placement of order)
3. Country of Origin: _____
4. Warranty Period: _____

General

1. GST Number: _____ (Enclose Copy)
2. NTN / CNIC: _____ (if exempted, provide valid exemption certificate)

Payment Terms

1. 80 % through LC on sight.
2. 20% after delivery, installation / commissioning, user satisfaction certificate.

Details of Foreign Principal Information with account details)

1. Name / Title: _____
2. Address: _____

OEM Name:	Firm Name:	Signature:
OEM Focal Person:	Firm Focal Person:	Official Seal:
OEM Phone Number:	Firm Phone Number:	Name:
OEM Email Id:	Firm Email Id:	Designation:

Annex CFINANCIAL OFFER

Ser	Part No	Item Name/Size	Specification	A/U	Qty Req	Price Per Unit (USD)	Total Price (USD)
1.		Power Electronics Trainer (Complete Package)	<p>Selenium rectifier Qty. 1 Rated alternated voltage: 30 Vrms Rated continuous voltage: 24 Vav Rated continuous current: 10 Aav</p> <p>Silicon diode Qty. 4 Direct average current: IFAV = 12 A max. Direct non repetitive overload current: IFSM = 75 A (tp = 10 ms) Repetitive peak reverse voltage: URRM = 1000 V Recovery reverse time: trr = 65 ns max.</p> <p>Group of diodes Qty. 1 Six fast acting silicon diodes with RCD protection network suitable for realizing non-controlled rectifying circuits. Direct average current: IFAV = 12 A Direct non repetitive overload current: IFSM = 75 A (tp = 10 ms) Repetitive peak reverse voltage: URRM = 1000 V Recovery reverse time: trr = 65 ns max.</p> <p>SCR Qty. 1 Direct average current: ITAV = 7.6 A max. True RMS value of the direct current: ITRMS = 12 A Max. repetitive reverse voltage: URRM = 800 V Trigger current: IGT = 15 mA max. Trigger voltage:</p> <p>Group of SCR Qty. 2 Six silicon controlled rectifiers with RCD protection</p>	No	2		

		<p>network used for realizing controlled rectifiers and inverters. Direct average current: $ITAV = 7.6 \text{ A max.}$ True RMS value of the direct current: $ITRMS = 12 \text{ A}$ Max. repetitive reverse voltage: $URRM = 800 \text{ V}$ Trigger current: $IGT = 15 \text{ mA max.}$ Trigger voltage: $UGT = 1.5 \text{ V max.}$ $I2t = 72 \text{ A}^2\text{s}$</p> <p>Triac Qty. 1 Bidirectional thyristor used for the control in alternated current. Complete with RC suppressor network. True RMS value of the direct current: $ITAV = 8 \text{ A max.}$ Non-repetitive peak current: $ITSM = 70 \text{ A, 50Hz (77A, 60Hz)}$ Max. repetitive reverse voltage: $UDRM = 800 \text{ V}$ Trigger current: $IGT = 25 \text{ mA max. (all the quadrants)}$ Trigger voltage: $UGT = 2.5 \text{ V max.}$ State keeping current: $IH = 25 \text{ mA max.}$ $I2t = 24 \text{ A}^2\text{s}$</p> <p>MOSFET Qty. 1 N-channel enhancement mode power MOS with integrated reverse diode (FRED, Fast Recovery Epitaxial Diode) used as very fast switch in switching regulators and inverters. Drain-source voltage: $UDS = 400 \text{ V}$ Continuous drain current: $ID = 10 \text{ A}$ Drain-source on-state resistance: $RDS(on) = 0.55 \Omega$ Gate-source voltage: $UGS = \pm 20 \text{ V}$</p> <p>IGBT Qty. 2 N-channel Insulated Gate Bipolar Transistor (IGBT) with anti parallel hyper fast protection diode used as very</p>				
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			<p>fast switch in switching regulators and inverters. Collector-emitter voltage: $U_{CES} = 600 \text{ V}$ Continuous collector current: $I_c = 24 \text{ A}$ at $T_c = 25^\circ\text{C}$ Collector-emitter saturation voltage: $U_{CESat} = 1.8 \text{ V}_{typ}$ at $I_c = 15 \text{ A}$ Gate-emitter voltage: $U_{GE} = \pm 20 \text{ V}$ Group of IGBT Qty. 1 4 N-channel Insulated Gate Bipolar Transistors (IGBT) with anti parallel hyper fast protection diode used as very fast switches in switching regulators and inverters. Collector-emitter voltage: $U_{CES} = 600 \text{ V}$ Continuous collector current: $I_c = 24 \text{ A}$ at $T_c = 25^\circ\text{C}$ Collector-emitter saturation voltage: $U_{CESat} = 1.8 \text{ V}_{typ}$ at $I_c = 15 \text{ A}$ Gate-emitter voltage: $U_{GE} = \pm 20 \text{ V}$ Bridge three phase rectifier Qty. 1 Non-controlled three-phase rectifier in six pulse bridge connection B6UK for the generation of a DC voltage from a three phase mains. Rated alternating input voltage: $U_{VN} = 400 \text{ V}$ Direct output voltage: $U_d = 540 \text{ V}$ Rated direct current: $I_{dN} = 10 \text{ A}$ Surge forward current: $I_{FSM} = 300 \text{ A}$ $I_2t = 400 \text{ A}^2\text{s}$ Voltage drop: $U_F = 1 \text{ V}$ per diode SCR with turn off circuit Qty. 1 Main SCR and auxiliary SCR, complete with RC uppressor circuit. Direct average current: $I_{TAV} = 13 \text{ A}$ max. Max. repetitive reverse voltage:</p>			
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		<p>UDRM = 800 V $t_q = 35$ ms Block diodes and flywheel, complete with RC suppressor circuit. Max. repetitive reverse voltage: UDRM = 600 V IAV = 8 A Turn off capacitor: C = 2 μF Oscillation coil: L = 1 mH Shunt for the measurement of the currents in each branch: 4 x 0.1 Ω</p> <p>DC Power Supply Qty. 1 Laboratory power supply with two fixed voltage outputs and protected against short-circuit. Output voltages: +15 V ; 0 V ; -15 V Output current: 2,4 A (3 A for a short period) Power supply: single-phase from mains Two led (+15 V ; -15 V) for the indication of the nominal voltage. Mains switch with pilot lamp</p> <p>Voltage Reference Generator Qty. 1 Power supply: +15 V ; 0 V ; -15 V Range of the continuous regulation reference signal: from - 10 V to + 10 V, from 0 to + 10 V Range of the step reference signal: from - 10 V to + 10 V, from 0 to + 10 V Switch for selecting between internal potentiometer reference signal and external reference signal Switch for selecting between the 0 / \pm10 V range and the 0 / +10 V range</p> <p>Trigger point limiter Qty. 1 Stability limit for rectifier: 0° to 180° Stability limit for inverter: 180° to 0° Power supply: +15 V / 0 V / - 15 V</p> <p>Two pulse control unit Qty. 1 Power supply: +15V/ 0V / - 15V (25mA)</p>				
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		<p>Synchronization voltage: 1 to 440 V Control voltage U_c: 0 V to 10 V Trigger angle: 180° to 0° Number of outputs: 2 x 2 Possibility of pulse train or single pulse. Possibility of selecting two natural switching points: 0° and 30°. Inhibit voltage: U_{INH} = 15 V (open): trigger pulses. U_{INH} = 0 V: no trigger pulses.</p> <p>Six pulse control unit Qty. 1 Power supply: +15V/0V/- 15V (300mA) Synchronization voltage: 1 to 440 V Analogue control voltage U_c: 0 to 10V Digital TTL control: DWH = FH...FFH (15...255)10 Trigger angle: 180° to 0°(300°...120°/60°...240°) Number of outputs: 3 x 2 Possibility of pulse train or single pulse. Possibility of excluding the secondary pulse. Possibility of selecting three natural switching points: 0°, 30°and 60°. Inhibit voltage: U_{INH} = 15 V (open): trigger pulses. U_{INH} = 0 V: no trigger pulses</p> <p>PWM, PFM, TPC control unit Qty. 1 Power supply: +15V/0V/- 15V (600 mA) Control voltage: U_c: 0 to 10V PWM: 20-200 Hz/0.2-2 kHz/2-20 kHz Duty cycle D = t_{on}/T = 0-0.95 PFM: 5-50 ms/50-500 ms/0.5-5 s Frequency: 20 Hz to 20 kHz TPC: Hysteresis: U_H = 0 to 2 V Number of outputs: 2 x 2, with led indication of the status</p>				
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		<p>Output amplifier: threshold voltage 5 V, short-circuit proof Inhibit voltage: UINH = 15 V (open): trigger pulses. UINH = 0 V: longer pulses at certain outputs only.</p> <p>Run-up control unit Qty. 1 Power supply: -15 V/0 V/ 15 V Input signal range: $U_i = -10 \text{ V} \dots 10 \text{ V}$ Fine adjustment of the slew-rate: 0.5 . . . 50 V/s Fine adjustment of the voltage gain: 0.1 . . . 1 Inhibit voltage: UINH = 0 V: zero output voltage U_0 and output UINH = 15 V UINH = 15 V (open): output voltage U_0 runs up and output UINH = 0 V</p> <p>PID Controller Qty. 1 Standard industrial controller that can be used as P, PI, PD or PID controller in the closed loop automatic control systems. Power supply: +15 V ; 0 V ; -15 V Input summing node for two different reference variables UR and UC and for one controlled variable UA. Signal voltage range: -10V +10V Parameters of the controller continuously adjustable Proportional gain: $K_p = 0 \dots 1000$ Time of the integral action: $T_I = 1 \text{ ms} \dots 100 \text{ s}$ Time of the derivative action: $T_D = 0.2 \text{ ms} \dots 20 \text{ s}$ Reset input of the integral controller. Output summing node to add or subtract noise variables. Measurement terminal for the error signal. Adjustment screw for the output offset. Three led indicator of the sense of deviation. Coarse and fine adjustment of the proportional gain K_p, of</p>				
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		<p>the time of the integral action TI and of the time of the derivative action TD.</p> <p>Indicator of over-range: led "over" on when the output voltage is higher than 10 V or lower than -10 V.</p> <p>Input off for resetting the I controller.</p> <p>Absolute value generator Qty. 1</p> <p>Power supply: -15 V/0 V/+15 V</p> <p>Input signal range U_i: -10 V . . . + 10 V</p> <p>Adjustable gain: 0 . . . 1</p> <p>Inverting control input:</p> <p>$U_{INV} = 0$ V: the input signal is inverted</p> <p>$U_{INV} = 15$ V or disconnected: the input signal is not inverted</p> <p>Inhibit voltage:</p> <p>$U_{INH} = 0$ V: the output signal is zero</p> <p>$U_{INH} = 15$ V (open): the absolute value circuit is active</p> <p>Adaptive PI controller Qty. 1</p> <p>Double compact PI controller for use as current controller in dc servo drives.</p> <p>Power supply: -15 V/0 V/+15 V</p> <p>Input summing point for two different reference variables U_R and U_C and one controlled variable U_A.</p> <p>Signal voltage range: -10 V . . . + 10 V</p> <p>Continuously adjustable parameters of the two controllers:</p> <p>proportional gain $K_p = 0 . . . 1000$</p> <p>integral action time $T_I = 0.2$ ms . . . 20 s</p> <p>Integral element reset by switch or via external signal.</p> <p>Regulator selection by switch or via external signal.</p> <p>Gain and Offset Adjust Qty. 1</p> <p>Power supply: +15 V ; 0 V ; -15 V</p> <p>Voltage interval of the input signal: -50 V, ..., +50 V</p> <p>Adjustable level through the setting of the gain: 01, 0 10, 0 100</p>				
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		<p>Attenuation of the pulse signals. Time constants: 0,1 10 ms ; 10 100 ms Offset voltages that can be connected: -10 V +10 V Coarse setting through rotary switches. Potentiometer fine setting.</p> <p>Mains transformers Qty. 1 Three-phase transformer able to supply single and three phase voltages as well as a rectified voltage for the excitation of the dc machines. Three pilot lamps for signaling the mains voltage. AC output through isolation transformer: 3 x 90 V/1.5 A with 3 intermediate sockets at 45 Vac. DC output, non isolated from mains: 1 x 220 V/1 A, switch with pilot lamp and magneto-thermal protection 1 A</p> <p>Capacitors Qty. 1 Two electrolytic high performance capacitors. Rated value: 2 x 1000 μF Rated voltage: 385 V Protection against polarity inversion. Discharge resistance: 330 kΩ (t = 330 s)</p> <p>Super-fast fuses Qty. 2 Nominal voltage: 660 Vac Nominal current: 3 x 6.3 A and 3 x 10 A</p> <p>Switching transformer Qty. 1 Ferrite core N27 without air gap. Primary: 2 x 115 V, 2 x 48 turns Thermal protection: 2 x 0.6 A Secondary: 2 x 15 V/ 4.5 A, 2 x 7 turns Inter-winding shield. Rated power: 135 VA Rated frequency: 15 kHz</p> <p>Current transformer Qty. 1 For potential-free measurements of ac currents in single</p>				
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		<p>and three-phase without neutral. Current: 10 A Unsmoothed output voltage for synchronization. Smoothed output voltage for current regulator. Transformation ratio: 2 V / 1 A and Insulation voltage: 3 kV</p> <p>Trigger pulse switch Qty. 1 For switching the trigger pulses from the control unit to double converters in 4-quadrant systems. Two pulse inputs and Two control inputs. Eight electrically isolated pulse outputs and Power supply: +15 V</p> <p>Switching logic Qty. 1 Input Xn for torque comparator (speed set point value). Input Xi for current comparator with adjustable limit threshold. Output SA and SB for the corresponding inputs of the trigger pulse switch with led indication of the active converter. Output INV for the corresponding inverting input of the absolute value generator. Output INH for the corresponding inhibit input of the two pulse control unit, with adjustable delay time from 10 ms to 2 s and led indication of the commutating time. Current comparator output C for EXT selection input of the active elements of the adaptive PI controller. Power supply: +15 V/0 V/-15 V</p> <p>Function generator Qty. 1 Functions: sine / triangle / square wave / square wave with variable duty cycle. Frequency range: 10 Hz . . . 100 kHz in 4 decades. Output voltage: 0 V to 20 Vpp adjustable Two additional outputs with attenuator: -20 dB/ -40 dB TTL output for triggering. VCO input, AC coupled.</p>				
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			<p>Power supply: single-phase from mains</p> <p>Voltage divider 20:1 Qty. 1 Electronic voltage divider used as an interface between the dc machines (200 V) and the automatic control circuits (-10 V ... +15 V). Possibility of capacitive filter with time constant 0.1 s. Protection against over voltages up to 1000 Vdc. Power supply: +15 V / 0 V / - 15 V</p> <p>Universal Load Qty. 1 Ohmic, inductive and capacitive load suitable for the experiments in the power electronics laboratory. a) Load resistors: 3 x 100 Ω/1 A and Protection with fuses: 3 x T1.25 A Possibility of connecting in series (300 Ω), in parallel (33.33 Ω) or in star and delta b) Load inductors: 2 x (12.5 - 50) mH/2.5 A Possibility of connecting in series (100 mH) and in parallel (6.25 mH). c) Load capacitors: 4-8-16 μF/450 Vac Possibility of connecting in parallel (28 μF). Discharge resistor: 1 kΩ/0.22 A</p> <p>Socket with lamps Qty. 1 Three lamp-holders E14. Complete with three incandescent lamps: 40 W/220 V. Possibility of connecting in parallel.</p> <p>Stabilized power supply Qty. 1 The power supply has two sections: Regulated variable voltage section, used to supply the armature of dc motors. Output: 0 ÷ 240 Vdc, 5 A Drive: manual or external via 0 ÷ 10 Vdc signal Constant voltage section, used to supply the excitation circuit of dc machines. Output: 220 Vdc, 1 A</p>			
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			<p>Phase control fault simulator Qty. 1 Double time-constant standard light dimmer circuit consisting of triac, diac, two control potentiometers, resistors and capacitors. A total of 20 faults can be switched on using switches located behind a cover. Typical faults: interruptions, short-circuit, faulty components and faulty design. Power supply: 110 to 230 V, 47-63 Hz Ohmic load: 1.2 kW max</p> <p>EMI Filter Qty. 1 Inductances on the line: 0.4 mH Capacitors between conductors and neutral: 100 nF Capacitor between neutral and ground: 22 nF</p> <p>Isolation amplifier Qty. 1 Isolation amplifier, channels A, B, C, E: - Frequency range: dc to 80 kHz. - Max Input voltage: Max 620 Vdc/460 Vac Input resistance $R_i = 1 \text{ MW}$ in all ranges - Input current (between 0 and I) Max: 10 A continuous; 16 A for $t < 15 \text{ min}$; 20 A for $t < 2 \text{ min}$. Internal resistance: 30 mW in all ranges Five outputs: A, B, C, D, E with led for over range Indication Output resistance $R_O: 100 \text{ W}$ - Multiplexer: Mux channels, selectable: 1 to 8 (4 x signal; 4 x zero line) Gain attenuator, adjustable: 0.2 to 1. Y-position, adjustable: -8 V to + 8 V. Mux frequency, adjustable: 50 kHz to 500 kHz (typical). Two BNC outputs for oscilloscope Mathematical module and filter: - Functional modes for channel D: Addition A+B; subtraction AB; multiplication $A \times B / 10$ or $A \times B$; reconstruction of the phase</p>				
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		<p>voltage LIN(A, B, C) from the line-to line voltages; channel E switched into channel D for multiplexing.</p> <ul style="list-style-type: none"> - Filter <p>Low pass active filter of the 2° order required for the recovery of the fundamental wave out of the PWM signals. Cut-off frequency: 1 kHz.</p> <p>Space vector indicator:</p> <ul style="list-style-type: none"> - Voltage vector: indication with 7 led. - Magnetic flux vector: BNC outputs X e Y for oscilloscope. <p>Power supply:</p> <ul style="list-style-type: none"> - Single-phase from mains Frequency: 50/60 Hz. <p>Support with 3 shunts 1 ohm Support with 3 shunts, with different connection possibilities. Resistance: 1 Ω ; Accuracy: ± 1% ; Max. current: 2.5 A Support with 3 shunts 0.1 ohm Qty. 1</p> <p>Support with 3 shunts, with different connection possibilities. Resistance: 0.1 Ω ; Accuracy: ± 1% ; Max. current: 8 A Frequency converter Qty. 1</p> <p>Transistor pulse-converter with pulse driven voltage source inverter and transistor for the generation of a three-phase, variable frequency and variable voltage system. In conjunction with the PWM control unit this device is used for the realization of a frequency converter for asynchronous motor drive. Output voltage: 3 x 0...230 V Output current: 3 x 8 A max. Supply voltages: power circuit, 1 x 255 V max, 50/60 Hz control circuit, single-phase from mains PWM Control Unit Qty. 1</p>			
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		<p>Control unit used in conjunction with the frequency converter to build a voltage-source inverter which operates with PWM control.</p> <p>All of the control, monitoring and measuring functions are integrated into the control unit while the frequency converter contains solely the power components.</p> <p>A PWM modulator controls the power transistors of the inverter and thus generates a sine-shaped motor current. Modulation possibilities: PWM, VVC, trapezium shaped and block type.</p> <p>PC Interface Qty. 1</p> <p>IN/OUT connector for connection to the control unit and display for the visualization in hexadecimal of the control word.</p> <p>Two AO lines for analogue outputs: ± 10 V.</p> <p>Six AI lines for analogue inputs: ± 10 V</p> <p>The analogue signal is obtained from a D/A converter with 12 bit resolution.</p> <p>Auxiliary relay with led to show the switching status. USB connection.</p> <p>Power Electronics Software Qty. 1</p> <p>With this software it is possible to measure the wave forms for voltage and current that can be found in the static inverter and converter circuits.</p> <p>Through a microprocessor based interface it is possible to detect the wave forms and to send the controls to obtain trigger angles through software.</p> <p>On the screen the true RMS value, the mean value, the power and other parameters are calculated in order to allow the evaluation of the efficiency of the different circuits.</p>				
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		<p>The software features a very accurate graphic presentation and a user friendly interface with the end user.</p> <p>Induction Motor Control Software Qty. 1 With this software it is possible to realize the PWM, VVC, trapezium shaped and block type, full and half frequency control of the frequency converter and to do the acquisition of the mechanical characteristics of the induction motor under testing. Voltages, currents and other main characteristics are calculated both in numbers and as curves. The software features a very accurate graphic presentation and a user friendly interface with the end user.</p> <p>Variable Three Phase Transformer Qty. 1 Power supply: three-phase from mains Rated output: 550 VA Secondary phase current: 1.25 A Secondary voltage: 0 to 440 V The voltage is set by means of a variable autotransformer with rotary knob and the output is floating by means of an isolating transformer with subdivided secondary winding. Fitted with mains lamp and motor circuit breaker.</p> <p>Battery stack Qty. 1 Two rechargeable batteries, maintenance free and Capacity: 1.8 Ah/12 V</p> <p>Tachometer Qty. 1 Speed ranges: 1500/3000/6000 rpm Accuracy class: 1.5 Output voltage: 1 V/1000 rpm</p> <p>Single phase supply unit Qty. 1</p>				
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		<p>Power supply: single-phase from mains Cam operated 2-pole mains switch 16 A Automatic circuit breaker: 10 A, operated by thermal effect Output terminals L and N, with pilot lamp Pilot lamp for indication of mains false polarity</p> <p>Three phase supply unit Qty. 1 Power supply unit for three-phase connection with 4-pole cam mains switch. 25 A current operated earth leakage circuit breaker, sensitivity 30 mA. Triple-pole motor protection switch: 6.3 to 10 A. Three-phase indicator lamps. Output through 5 safety terminals: L1, L2, L3, N and PE.</p> <p>Digital AC/DC Multi-range Power meter Qty. 1</p> <ul style="list-style-type: none"> • Automatic Scaling • Current range: 0-20 Iac/dc 20 - 100Hz • Voltage range: 0-750 Vac/dc 20 - 100Hz • Power range: 0-1000W, VAR and VA • Accuracy: +/- 0.5% • Resolution: 16bits • Refresh rate : 0.5s • Power supply: 90-260 Vac 50/60Hz • Power consumption: 3 VA • Communication: Modbus (RS485) <p>True rms meter Qty. 2 Voltage: 0 .. 1000V DC 0 .. 1000VACpp 0 .. 750VACrms Current: 0 .. 20 A Continuous overload protection in all ranges.</p> <p>Moving iron voltmeter Qty. 1</p>				
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		<p>Scale: 50 divisions Range: 125-250-500 V Range changeover switch.</p> <p>Moving coil ammeter Qty. 1 Scale: 50 divisions and Range: 2.5 A</p> <p>Asynchronous squirrel cage three phase motor Qty. 1 Squirrel cage three-phase asynchronous induction motor, with three-phase stator winding and squirrel cage buried in the rotor. Rated power: 180 W and Voltage: 380/690 V Δ/Y</p> <p>Slip ring three phase asynchronous motor Qty. 1 Induction motor with both stator and rotor three-phase windings. Power: 250 W ; Voltage: 220/380 V D/Y ; Current: 1.65/0.95 A D/Y Excitation: 92 V, 2 A ; Frequency: 50 Hz ; $\text{Cos}\phi$: 0.66 Speed: 1350 rpm and Thermal protection.</p> <p>Rheostatic rotor Qty. 1 Steps operated starter for three phase induction motor with slip ring rotor. Step resistance value: 3 x (12-6-3-1-0) W Current: 3 x 2.5 A max.</p> <p>Shunt excitation direct current motor Power: 200 W ; Voltage: 220 V ; Current: 1.5 A Excitation: 200 V, 0.067 A ; Speed: 3000 rpm Thermal protection.</p> <p>Shunt excitation direct current motor Qty. 1 Power: 160 W ; Voltage: 220 V ; Current: 0.73 A Excitation: 220V, 0.075A ; Speed: 2850 rpm Thermal protection</p>				
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		<p>Shunt excitation direct current generator Qty. 1 Power: 160 W ; Voltage: 220 V ; Current: 0.73 A Excitation: 220V, 0.075A ; Speed: 2850 rpm Thermal protection.</p> <p>Powder brake Qty. 1 Maximum braking torque: 12 Nm Power: 400 W ; Voltage: 0 ÷ 24 V Speed: 4000 rpm max. and Thermal protection.</p> <p>Load cell Qty. 1 Resistance electronic strain-gauge with 100 N range, to be mounted on the brake unit for measuring the mechanical torque.</p> <p>Powder brake control unit Qty. 1 Speed section: - K2 connector for the speed transducer - Circular scale three-range instrument: 1500/3000/6000 rpm - Analogue output: 1 mV/rpm Torque section - K connector for the torque transducer - Circular scale three-range instrument: 1.5/3/10 Nm - Analogue output: 1 V/Nm Brake control - Output power: 0 to 12 Vdc, 0.5 A - Manual, external or automatic regulation. Thermal protection with alarm indication and Recorder pen control.</p> <p>Base Qty. 1 Metallic structure, fire varnished, suitable for mounting the machine or the group under test. Complete with optical transducer for rotating speed detection and with anti-vibration rubber feet.</p>				
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			<p>Flywheel Qty. 1 Used in deceleration tests on rotating machines for calculation of Mechanical iron and copper losses at different excitations.</p> <p>Stop clock Qty. 1 Stopwatch with LCD display. Measuring range: 9 h, 59 min, 59 s, 99/100 s and Battery: 1.5 V</p> <p>Frame Qty. 2 Metal frame for assembling the modules of the laboratory.</p> <p>Connecting leads Qty. 1 Set of connecting leads of different diameters and lengths.</p> <p>Storage Cabinet Qty. 1</p> <p>Or Equivalent</p> <p><u>Experimental Capabilities</u></p> <p>ALTERNATE CURRENT - DIRECT CURRENT CONVERSION (RECTIFIERS)</p> <p>DIODES AND UNCONTROLLED RECTIFIERS</p> <ul style="list-style-type: none"> • Single pulse rectifier, ohmic load • Single pulse rectifier, ohmic-inductive load • Two-pulse rectifier, ohmic load • Two-pulse rectifier, ohmic-inductive load • Two-pulse bridge rectifier, ohmic load • Two-pulse bridge rectifier, ohmic-inductive load • Three-pulse rectifier, ohmic load • Three-pulse rectifier, ohmic-inductive load • Six-pulse rectifier, ohmic load • Six-pulse rectifier, ohmic-inductive load 				
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		<ul style="list-style-type: none"> • Six-pulse bridge rectifier, ohmic load • Six-pulse bridge rectifier, ohmic-inductive load <p>SCR AND CONTROLLED RECTIFIERS</p> <p>Single pulse converters</p> <ul style="list-style-type: none"> • Single pulse converter, ohmic load • Single pulse converter, inductive load • Single pulse converter, ohmic-inductive load • Single pulse converter, ohmic-inductive load and free-wheeling diode • Single pulse converter, ohmic-inductive load and back e.m.f. • Single pulse rectifier, ohmic-capacitive load • Single pulse converter, ohmic-capacitive load <p>Two-pulse midpoint converters</p> <ul style="list-style-type: none"> • Two-pulse midpoint converter, ohmic load • Two-pulse midpoint converter, ohmic-inductive load <p>Multi-phase converters</p> <ul style="list-style-type: none"> • Three-pulse midpoint converter, ohmic load • Three-pulse midpoint converter, ohmic-inductive load • Six-pulse midpoint converter, ohmic load • Six-pulse midpoint converter, ohmic-inductive load <p>Drainage-coil converters</p> <ul style="list-style-type: none"> • Double three-pulse star converter, ohmic load <p>Bridge converters</p> <ul style="list-style-type: none"> • Half-controlled bridge, ohmic load • Half-controlled bridge, ohmic-inductive load • Half-controlled bridge, ohmic load • Half-controlled bridge, ohmic-inductive load • Fully-controlled bridge, ohmic load • Fully-controlled bridge, ohmic-inductive load • Fully-controlled bridge, ohmic load and back e.m.f. • Fully-controlled bridge, dc motor load 				
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		<ul style="list-style-type: none"> • Fully-controlled bridge, ohmic load and supplementary dc voltage • Fully-controlled bridge, dc generator load • Three-phase half-controlled bridge, ohmic load • Three-phase fully-controlled bridge, ohmic load • Three-phase fully-controlled bridge, ohmic-inductive load <p>THYRISTORS & CONTROLLED AC/AC CONVERTERS</p> <p>Single-phase controllers</p> <ul style="list-style-type: none"> • Single-phase ac controller, ohmic load • Single-phase ac controller, inductive load • Single-phase ac controller, ohmic-inductive load • Single-phase ac controller, ohmic load • Single-phase ac controller, ohmic-inductive load • Half-controlled single-phase controller, ohmic load <p>Three-phase controllers</p> <ul style="list-style-type: none"> • Fully controlled three-phase controller, star ohmic load without neutral • Fully controlled three-phase controller, star ohmic load without neutral • Three-phase controller, star ohmic load without neutral <p>LIGHT DIMMER FAULT SIMULATOR</p> <p>Double time-constant standard light dimmer circuit consisting of triac, diac, two control, potentiometers, resistors and capacitors.</p> <p>Examples of exercises:</p> <ul style="list-style-type: none"> • Fault-free dimmer • DIAC shorted • DIAC with high resistance • The gate of TRIAC works like a diode • Control circuit break • Assembly or component fault • Trimmer shorted 				
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		<ul style="list-style-type: none"> • Auxiliary RC circuit not included • Variable resistance R shorted • TRIAC shorted <p>DIRECT CURRENT to DIRECT CURRENT CONVERSION(CHOPPERS)</p> <ul style="list-style-type: none"> • Main SCR • MOSFET • IGBT • Step-down converter with SCR with turn-off circuit. PWM control. • Step-down converter with IGBT. PWM control. • Speed control of a dc motor • Step-down converter with MOSFET. PWM control. • Step-down converter with MOSFET. PFM control. • Step-down converter with MOSFET. TPC control . • Step-up converter with IGBT. PWM control. • Step-up converter with IGBT. TPC control. • Inverting converter with IGBT. PWM control. <p>SWITCHABLE POWER SUPPLY</p> <ul style="list-style-type: none"> • Flyback converter with IGBT. PWM control. • Forward converter with IGBT. PWM control. • Asymmetric half-bridge forward converter with IGBT. PWM control. <p>DIRECT CURRENT - ALTERNATE CURRENT CONVERSION INVERTERS</p> <ul style="list-style-type: none"> • Single-phase full-bridge dc chopper. PWM control. • Single-phase full-bridge inverter. Square-wave PWM control. • Single-phase full-bridge inverter. Sinusoidal PWM control. <p>FREQUENCY CONVERTERS</p>				
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		<ul style="list-style-type: none"> • Frequency converter • Input controlled rectifier • Output power inverter <p>MOTOR DRIVES</p> <p>DC MOTOR DRIVE</p> <ul style="list-style-type: none"> • Single-quadrant drive with converter • Single-quadrant drive with converter and armature voltage feedback • Single-quadrant drive with converter and armature voltage feedback with RI compensation • Single-quadrant drive with converter and tacho-voltage feedback • Single-quadrant drive with converter and tacho-voltage feedback with inner current loop • Two-quadrant drive (I-IV) with converter • Two-quadrant drive (I-III) with converter • Two-quadrant drive (I-III) with converter and tacho-voltage feedback with inner current loop • Four-quadrant drive with converter • Four-quadrant drive with converter and tacho-voltage feedback with inner current loop • Single-quadrant drive with converter • Single-quadrant drive with converter and tacho-voltage feedback with inner current loop <p>AC SLIP-RING MOTOR DRIVE</p> <ul style="list-style-type: none"> • Control of stator voltage with transformer • Control of stator voltage with controller • Control of stator voltage and tacho-voltage feedback • Rotor starter • Rotor pulsed resistor • Rotor pulsed resistor and tacho-voltage feedback • Scherbius static drive 				
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		<ul style="list-style-type: none"> • Scherbius static drive and tacho-voltage feedback AC SQUIRREL CAGE MOTOR DRIVE • Preliminary investigation of the squirrel cage motor • Six-pulse PAM • Pulsed square-wave triggering • Trapezoidal modulation • Pulse width modulation (PWM) • Voltage vector control (VVC) • Motor magnetization for linear U/f characteristic • Extra start magnetization • IxR compensation • Operation in standard converter setting • Slip compensation • Motor operation in star connection • Brake chopper • Speed control with tacho-voltage feedback 					
Total Amount							

Firm Name: _____ Signature: _____ Name: _____ Designation: _____

Tender No _____

Name of the Firm _____

Firm Address _____

Date _____

Telephone No _____

E-Mail _____

To,

DD SCM Office
NUTECH University
I-12, Main IJP Road,
Islamabad.

Dear Sir

1. I / We hereby offer to supply to the NUTECH University the stores detailed in schedule to the tender inquiry or such portion thereof as you may specify in the acceptance of tender at the price offered against the said schedule and further agree that this offer will remain valid up to 90 days after opening of Financial offer and will not be withdrawn or altered in terms of rates quoted and the conditions already stated therein or on before this date. I / we shall be bound by a communication of acceptance to be dispatched within the prescribed time.

2. I / we have understood the instructions to Tenders and General Conditions Governing Contract available at NUTECH website and have thoroughly examined the specifications / drawing and / or patterns quoted in the schedule here to and am/are fully aware of the nature of the stores required and my/ our offer is to supply stores strictly in accordance with the requirements.

Yours Faithfully.

(Signature of Tenderer)

Designation

Date:

Individual signing tender and / or other documents connected with a contract must be signed by principal authorized rep/ OEM rep/ Authorized partner firm rep.

SPECIMEN FOR "ADVANCE PAYMENT BANK GUARANTEE"

Guarantee No: _____ Date _____ Amount: _____ Valid upto: _____

In Favour of:

National University of Technology (NUTECH), IJP Road, I-12, Islamabad

Subject: **Advance Payment Bank Guarantee**

Contract No: _____ DATED. _____

Dear Sir,

1. We [Name of Guarantor] understand that you have entered into contract with M/S [Name of Firm] (hereinafter called Our Client), for provision of [Name of Stores]. And as per the above mentioned Contract, you are liable to pay to Our Client an amount of [Amount of Guarantee] in advance, which shall be released against a Bank Guarantee.
2. Bank & seller firm shall inform your office regarding termination of the validity of this bank Guarantee one clear month before the actual expiry date of this Bank Guarantee.
3. Now, we hereby irrevocably undertake to immediately make payment on to your orders, merely upon receipt of your first written notice, an amount not exceeding [Amount of Guarantee] that may be claimed by you at your own discretion without it being necessary for you to prove or even assert to the Bank any default whatsoever of Our Client under the Contract.
4. Claims against this Guarantee shall be lodged on us through written request/s on your proper Letter Head. Unless claims are not presented on or before the Validity Date, all rights and benefits under this guarantee shall be forfeited and we shall be released from all claims, demands or liabilities of any kind whatsoever.
5. This Guarantee shall remain in force up to the above mentioned Validity Date which can however, be extended upon request of Our Client.

Yours faithfully,

Signature: _____

Name: _____

Designation: _____

Bank Stamp:

BANK GUARANTEE AGAINST
"SPECIMEN FOR PERFORMANCE/WARRANTY
GUARANTEE"

Guarantee No: _____ Date _____ Amount: _____ Valid upto: _____

In Favour of:

National University of Technology (NUTECH), IJP Road, I-12, Islamabad

Subject: **In compliance with terms of Performance/Warranty Guarantee**
Bank Guarantee

Contract No: _____ dated _____

Dear Sir,

1. Whereas your good-self have entered into Contract No: _____ dated _____ with M/s [Firm Name] Located at [Firm Address], Herein after referred to as our customer and that one of the conditions of the Contract is submission of Bank Guarantee by our customer to your good-self for a sum of [Amount].
2. Incompliance with this stipulation of subj contract, we hereby agree and undertake as under:-
 - a. To pay to you unconditionally on demand and / or without any reference to our Customer an amount not exceeding the sum of [Amount] as would be mentioned in your written Demand Notice.
 - b. To keep this Guarantee in force till [Validity Date].
 - c. That the validity of this Bank guarantee shall be kept two clear year ahead of the original / extended delivery period or the warrantee of the stores which so ever is later in duration on receipt of information from your office. Our liability under this Bank Guarantee shall cease on the closing of banking hours on the last date of validity of this Bank Guarantee. Claim received there after shall not been entertained by us whether you suffer a loss or not. On receipt of payment under this Guarantee, this

documents i.e., Bank Guarantee must be clearly cancelled, discharged and returned to us.

- d. That we shall inform your office regarding termination of the validity of this bank Guarantee on clear month before the actual expiry date of this Bank Guarantee.
- e. That with the consent of our customer you may amend / alter any term / cause of the contractor add / delete any term / clause to / from this contract without making any reference to us. We do not reserve any right to receive any such amendment / alternation or addition / deletion provided such like actions do not increase our monetary liability under this Bank Guarantee which shall be limited only [Amount.....].
- f. That the bank guarantee herein before given shall not be affected by any change in the constitution of the Bank or Customer / Supplier or Vendor.
- g. That this is an unconditional Bank guarantee, which shall be cashed on sight on presentation without any reference to our Customer / Supplier or Vendor.

Signature_____

Name_____

Desig_____

Bank Stamp_____

Note: No changes in the above given BG format shall be accepted.

"SELLER'S WARRANTY CERTIFICATE"

(To be provided on stamp paper)

Contract No: _____ Dated:

Validity ____ years from the date of final acceptance of the Stores.

We hereby guarantee that we are the genuine and original Source of provisioning the Stores to our Buyer. We also undertake that nothing in the manufacturing of these Stores has been obtained through unauthorized means.

1. We hereby warrant and undertake that the Stores and all the associated spares/ accessories supplied under the terms and conditions of the above Contract, are:

- a. brand new, complete in all respects, possessing good quality and standard workmanship; and
- b. liable for replacement/rectification free of charge, if during the Warranty period the same are found defective before or under normal use or these do not remain within the limits and tolerances stated under the specifications or in any way not in accordance with the terms of this Contract. All expenses incurred in removal, re-provisioning and reinstallation of such defective Stores or their parts shall also be borne by us.

2. The Warranty shall remain valid for a period of ____ years from the date of final acceptance of the Stores.

Signature & Stamp _____

Name & CNIC _____

Designation: _____

Date: _____

****Sellers warranty must be provided by the Seller (firm) on Rs 100 stamp paper along with bank guarantee/CDR/Pay Order without changing a word. BG with additional clauses will be rejected.**

CHECK LIST**(This checked list must be attached with your technical offer, duly filled and****Signed by authorized signatory)****Tender No _____****Date _____**

1	Tender Processing Fee	a. Tender processing fee ref no _____ b. Bank _____ c. Amount _____		
2	EM/ Bid Bond	a. EM/ Bid Bond ref no _____ b. Bank _____		
3	Form Annex A, A-1, B and C signed by Authorized Signatory		Yes	No
4	Offering specification of items as per IT		Yes	No
5	Accounting unit/Qty as per IT		Yes	No
6	Delivery Schedule as per IT		Yes	No
7	Country of origin of store _____			
8	Name of OEM:- _____			
9	Original Performa invoice (Mandatory)		Yes	No
10	Certified that there is no Deviation from IT conditions/ there is deviation from IT condition as per fol details		Yes	No
11	Blacklisting certificate on stamp paper. it is certified that our firm is neither default nor black listed by any govt organization directly or indirectly		Yes	No

Note: Fill and/or mark Yes/No where required

Signature of Firm Auth Signatory