Government of Rajasthan

Directorate of Technical Education,
W-6, Residency Road, Jodhpur

Serial No. : - F. (125)/DTE/E-5/2024-25/ 24 Date: 06-09-2024

Notice Inviting Bid 02/2024-25

Bid for supply machinery, tools and equipment for Govt. Polytechnic Colleges in Rajasthan are invited from interested bidder's up to 04.10.2024 at time 11:00 am. Other particulars of the bid may be visited on the procurement portal (http://eproc.rajasthan.gov.in, www.sppp.rajasthan.gov.in) of the state; and www.dte.rajasthan.gov.in departmental website. The approximate value of the procurement is Rs. 796 lakhs.

UBN: (TED2425GL0B00011)

Director
Directorate of Technical Education,
Jodhpur (Raj.)

GOVERNMENT OF RAJASTHAN

DIRECTORATE OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR

W-6, GAURAV PATH, JODHPUR. Phone- 0291-2434271
Visit us: www.dte.rajasthan.gov.in e-mail ID: dte_raj@rajasthan.gov.in

Serial No. : - F. (125)/DTE/E-5/2024-25/ 24 Date: 06-09-2024

-: E- Bid No. 02/2024-25:-

On behalf of the Governor of Rajasthan, the undersigned, in the prescribed form, invites bid from the Original Equipment Manufacturer /Authorized Reseller/ Bonafide Dealer to supply machinery, tools and equipment etc. to the concerned various Government Polytechnic Colleges of the state. Online Bids are invited from registered firm/ organization/ institute/ company/ corporation/ registered/ incorporated in India

Items No.	Items of Bid	Approx. cost (in lac)	Bid Security (in lac)	Bid document Fee (non refundable)	RISL Fee (non refundable)	Bid download start date and time	Bid download Last date and time for downloading and submitting Bid	Date and time of opening of technical Bid
1.	Electrical Lab	796	15.92	2000/-	2500/-	06-09-2024 5.00 PM	04-10-2024 11.00 AM	04-10-2024 3.00 PM

UBN- (TED2425GLOB00011)

01. Details related to the Bid can be seen on the web site www.dte.rajasthan.gov.in www.sppp.rajasthan.gov.in . The Bid form can be downloaded/uploaded from the website www.eproc.rajasthan.gov.in .
02. Conditional Bid will not be accepted.
03. Rajasthan Public Procurement Transparency Act-2012 and Rules-2013 are effective in the state. Therefore, all the provisions of the said Act and rules will be effective on the bid.
04. Jurisdiction for all disputes will be Jodhpur (Rajasthan).

Director
Directorate of Technical Education
Jodhpur (Rajasthan)

निविदा सम्बन्धी दस्तावेज निम्नानुसार अपलोड करावें। (चैकलिस्ट)

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24.	GST Registration Certificate and GST Challan	
25.	Scanned copy of PAN card	
26.	Technical Specification Annexure –H(original downloaded &(original uploaded otherwise bid should not be considered.)	
27.	Annual Turnover Certificate from Chartered Accountant (Letter Head with seal, e-mail address, Mobile Number, Firm full address)	
28.	Literature/Leaflets/Catalogue	
29.	Authorization Certificate	
30.	Scanned copies of Bid Fee DD / E-Gras Challan Rs. 2000/- submit to Director, Technical Education, Jodhpur	
31.	Scanned copies of Bid Security DD E-Gras Challan Rs. 1592000/-submit to Director, Technical Education, Jodhpur	
32.	Scanned copies of BidProcessing DD / E-Grass Challan Rs 2500/- submit to MD RISL.	
33.	Any other Document	
34.	Authorization of Digital Signature (if applicable)	
35.	Scanned copy of power of Attorney to sign the Tender document (If Required)	
COVER – II : Financial/Price Bid/BOQ (.xls)		
36.	Price bid/BOQ Details of Price quoted of the material offered in Price bid/ BOQ	

निम्नांकित बिन्दुओं की पालना अवश्य ही करें :–

1. लीफलेट/केटलॉग/लिट्रेचर प्रत्येक आईटम अनुसार होना चाहिये (जिसमे मैन्यूफेक्चर का पूरा नाम, पत्राचार व्यक्ति के मोबाईल नम्बर/दूरभाष नम्बर/ई–मेल पूर्ण अंकित हो) जिस पर एनेक्शर "एच" के किस क्रम संख्या से सम्बन्धित है क्रम संख्या अंकित करावें।
2. अगर आपको क्रयादेश जारी किया जाता है तो क्रयादेश में वर्णित आपूर्ति अवधि में सामानो की आपूर्ति करावें। अगर किन्ही परिस्थितियों के दृष्टिगत आप समयावधि में आपूर्ति नहीं कर सकते है तो आपूर्ति अवधि समाप्त होने से पहले विभाग को लिखित में सूचित करेंगे, अन्यथा संस्था प्रधान द्वारा आपूर्ति स्वीकार नहीं की जायेगी। नियमानुसार निदेशालय द्वारा आपूर्ति अवधि बढाने के पश्चात् ही सामानों की आपूर्ति करावें।
3. एनेक्शर "एच" जो डाउन लोड किया जायेगा उस में सूचना भरकर उसी को अपलोड किया जायेगा आपके लेटर पर एनेक्चर "एच" तैयार कर अपलोड नहीं किया जायेगा। फिर भी आपके द्वारा फर्म के लेटर पर अलग से एनेक्चर एच तैयार कर अपलोड किया जायेगा तो उस निविदा को रिजेक्ट कर दिया जावेगा। जिसके सम्बन्ध में किसी प्रकार के पत्राचार पर विचार नहीं किया जायेगा।
4. क्रम संख्या 1 से 23 के डोक्यूमेन्ट डाउन लोड करने के पश्चात पूर्ण सूचना भर पुनः अपलोड किया जायेगा। फर्म के लेटर पर क्रम संख्या 1 से 23के डोक्यूमेन्ट तैयार कर अपलोड नहीं किये जायेगें।
5. निविदा भरने में या किसी प्रकार का संशय हो तो दूरभाष संख्या 0291–2434271, 2434395 पर प्रातः 11.00 बजे से दोपहर 4.00 बजे तक वार्ता कर सकते है।

I/we have carefully read and understood above instruction

Signature of bidder with seal

GOVERNMENT OF RAJASTHAN
DIRECTORATE OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR
W-6,GAURAV PATH, JODHPUR. Phone-0291-2434271Fax-2430398
Visit us: www.dte.rajasthan.gov.in e-mail ID: dte_raj@rajasthan.gov.in

BID DOCUMENT FORM

1. Name of item :- **Electrical Lab Items**.
2. Name & full address of the firm submitting the bid along with Tel. No., Fax No. & e-mail/ Mobile No.

   M/s : .....

   Full Address : .....

   Tel. No./FAX/Mobile : .....

   e-mail : .....
3. Addressed to :-**Director (Education), Directorate of Technical Education Rajasthan, Jodhpur- 342032** (e-mail :- dte_raj@rajasthan.gov.in)
4. Reference : e-Tender Notice No 2/2024-25 Dated 06-09-2024
5. The estimated cost of the tender is Rs. 796 Lakhs. The Processing fee of Rs. 2500/-, Bid feeRs. 2000/- and Bid Security (EMD) Rs. 1592000/- should be deposited vide Demand Draft or vide e-GRAS challan in concern head.
6. All documents required as per bid documents are enclosed.
7. Goods will be delivered within the stipulated delivery period from the date of the supply order at the designated place mentioned in the work order which may be subject to change as per requirement of the department.
8. I/ We agree to abide by all the Terms & conditions mentioned in e-Tender Notice No.- 2 /2024-25 dated 06.09.2024 issued by the Department and also agree to further Terms & Conditions including general conditions of the said tender notice given in the attached sheets (all the pages, all document, all document Check list S.N. 1 to 35 and other required document of which has enclosed signed with stamp by me/ us in token of my/our acceptance of the terms & condition mentioned therein)otherwise concerned Tender will not be considered for Technical Evaluation full responsibility by me.

SIGNATURE OF THE BIDDER
WITH SEAL AND DESIGNATION

*The words bid or tender and bidder or tenderer where ever mentioned in attached documents are synonyms and having same meaning.

GOVERNMENT OF RAJASTHAN

DIRECTORATE OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR

Instruction to Bidders for Online Bidding (e-Tendering)

Information to be disseminated to prospective bidder regarding on line Bidding.

1.	The Bid document can be downloaded from web site http://eproc.rajasthan.gov.in& submitted online in electronic format on same web site.
2.	Office address :- Director (Education), Directorate of Technical Education Rajasthan, Jodhpur-342032Phone-0291-2434271 e-mail ID: dte_raj@rajasthan.gov.in
3.	To participate in online Bids, Bidders will have to possess Digital Signature Certificate (type II or type III) as per information Technology Act-2000 using which they can sign their electronic bids, Bidder can procure the same from any CC approved certifying agency, i.e. TCS safecrypt, Ncode etc. or they may contact e-procurment Cell Department of It & C, Government of Rajasthan for further assistance: Bidder who already have a valid Digital Certificate need not required to procure a new Digital Certificate. Contact No. : 0141-4022688 (Help desk 10 am to 6 pm on all working days) E mail: eproc@rajasthan .gov.in Address: e-Procurement Cell, RISL, Yojna Bhawan, Tilak Marg, C-Scheme, Jaipur.
4.	Bid Procedure: Two stage open competitive **e-Bid procedureat**http://eproc.rajasthan.gov.in Bid Evaluation Criteria (Selection Method): Least Cost Based Selection(LCBS)-L1 Bidder with the **lowest cumulative value** of the financial bid i.e. **(Lowest financial cost after adding the cost of all the items)** shall be declared as L1 bid.
5.	Before electronically submitting the Bid, it should be ensured that all Bid papers including conditions of contract etc. are digitally signed by the Bidder and filled up as per the Bid Guidelines.
6.	Training for the bidders on the usage of e-tendering System is also being arranged by RISL on regular basis. Bidders interested for training may contact e-Procurement Cell, RISL for booking the training slot.
7.	Bidders are also advised to refer "Bidders manual" available under "Downloads" section for further details about the e-tendering process.
8.	The tenderer should submit the original Bid security fee,Bid fee and Bid processing fee vide Demand Draft or eGRAS Challan at office premises before opening of Technical Bid. Instructions are as follows :- **Demand Draft** Bid fee worth Rs. 2000/- and Bid Security Fee worth Rs. 1592000/- shall be depostited in favour of "Director, Directorate of Technical Education, Jodhpur" payable at Jodhpur and Bid Processing Fee worth Rs. 2500/- shall be depostied in favour of "MD, RISL" payable at Jaipur **eGRAS Challan** Bid fee challan worh Rs. 2000/- shall be deposited in the following head **0075-00-800-(52)-[01]** Bid Security Fee Challan worth Rs. 1592000/- shall be deposited in the following head **8443-103-108-109** Bid Processing Fee single Challan worth Rs. 2500/- shall be deposited in the following head **8658-00-102-(16)-[01]**

9.	**Technical Bid (First Cover in pdf) failing which Bid is liable to be rejected.** **<u>As per point no 8 of General Conditions of Tender.</u>** **Second cover (Financial/Price bid/BOQ-xls)** should contain details of price quoted in BOQ. In absence of the above or wrongly placing the required documents in any other cover or not mentioning the desired information at the specified place/ column, the bid may not be considered and will be rejected. The provisions of RTPP Rules 2013 & RTPP Act 2012 and Finance Department, Government of Rajasthan, orders and circulars will prevail in this regard.
10.	Incomplete & conditional Bid in any respect will be rejected without any information.
11.	The Director (Education), Directorate of Technical Education Rajasthan, Jodhpur reserves the right to reject all/ any part of Bid received from the firms/ Bidders without assigning any reason thereof.
12.	**Note:** 1) Bidder (authorized signatory) shall submit their offer on-line in electronic formats both for technical and financial proposal. However, BC/DD/e-Gras Challan for Bid document Fees, RISL Processing Fees and Bid Security should be submitted physically at the office of procurement entity before opening of technical bid and scanned copy of same should also be uploaded along with the technical Bid/ cover. 2) In case, any of the bidders fails to physically submit the Banker's Cheque/ Demand Draft/e-Gras challan for Bid document Fees, Bid Security, and RISL Processing Fee before opening of technical bid, their Bid shall not be entertained. The Banker's Cheque/Demand Draft/e-Gras Challan for RISL Processing Fee should be drawn in favour of "MD, RISL." payable at "Jaipur", Bidding document fee and Bid Security should be drawn in favour of "DIRECTOR, DIRECTORATE OF TECHNICAL EDUCATION, JODHPUR" from any Scheduled Commercial Bank as per point no. 8 as above. 3) DTE will not be responsible for delay in online submission due to any reason. For this, bidders are requested to upload the complete bid well advance in time so as to avoid 11th hour issues like slow speed; choking of web site due to heavy load or any other unforeseen problems. 4) No contractual obligation whatsoever shall arise from the bidding document/ bidding process unless and until a formal contract is signed and executed between the procuring entity and the successful bidder. 5) Procurement entity disclaims any factual/ or other errors in the bidding document (the onus is purely on the individual bidders to verify such information) and the information provided therein are intended only to help the bidders to prepare a logical bid-proposal. 6) The provisions of RTPP Act 2012 and Rules, 2013 shall be applicable for this procurement.

	Furthermore, in case of any inconsistency in any of the provisions of this bidding document with the RTPP Act 2012 and Rules, 2013 the later shall prevail. 7) Each bidder shall submit only one bid. Multiple bids submitted by a bidder shall be summarily rejected.

DIRECTOR (EDUCATION)

TECHNICAL EDUCATION RAJASTHAN
JODHPUR

I/we have carefully read and understood above instruction

Signature of bidder with seal

GOVERNMENT OF RAJASTHAN
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Visit us: www.dte.rajasthan.gov.in e-mail ID: dte_raj@rajasthan.gov.in

GENERAL CONDITIONS OF TENDER

01. The bidders are requested to submit their bids prior to last date of submission to avoid Non-submission of their bids up to prescribed date due to non-availability of / hanging of website at last moments. The date of submission of bids will not be extended if system is hang up in last hours or congestion.

02. In case, the date fixed for opening of the tenders be declared as a public holiday, the bid shall be opened on the next date on which office re-opens after such holiday(s).

03. Physical submission of bids is not allowed.

04. Tenders shall be valid for a minimum period of **90 days** after the date of opening of tender. Tender mentioning a shorter validity period than specified are likely to be rejected.

05. The bidders who are interested in bidding can download tender documents from **www.eproc.rajasthan.gov.in** up to the stipulated date & time.

06. The bids will have to be Digitally signed by the bidder and submitted online in two covers in electronic format only on website **www.eproc.rajasthan.gov.in**

07. Furnishing of tender offer shall be strictly in the manner as prescribed in Instructions to bidder and terms & conditions of tender, failing which the tender is liable for rejection.

08. The following documents are to be uploaded in **Two covers** of the bid

(A) TECHNICAL BID (First cover-pdf) : The following documents are to be attached failing in which the bid is liable to be rejected :-

a. Scanned copies of Demand Draft or e-GRAS Challan of Bid fee, Bid Security,Bid Processing Fee as per point 8 of Instruction to Bidders for Online Bidding.
b. Scanned copies of Bid document form along with Conditions of tender (SR-16) &General Terms & Conditions duly signed and sealed.
c. Copies of acknowledgement of GST returns for the Latest quarter of the Current Financial Year (2024-25) are to be submitted along with G.S.T. registration certificate.
d. Instructions to bidders document duly signed & sealed by the bidder.
e. All the technical specification and details of the tendered item and technical specification in tabular form must be submitted as indicated at Annexure - H
f. Price charging certificate as per (Annexure G).
g. Declaration by the tenderer (SR 11). (Annexure E).
h. Scanned copy of PAN card.
i. Scanned copy of catalogue/ literature/ leaflet and authorization certificate must be uploaded along with the bid otherwise will not be considered for technical evaluation.
j. Scanned copy of Power of attorney for authorized signatory to sign the tender document on Rs. 100/- Notary Stamp (if required).
k. Prescribed check list.

Signature of tenderer with seal

l. Format of RTGS/NEFT as per Annexure -J

m. Any other documents which the bidder wants to submit and/ or any document as per tender.

o. The Average Annual Turnover of the bidder for last three financial years (2021-22 to 2023-24) will be minimum equal to 150% of the estimated bid value as per BID. A certificate issued by the Chartered Accountant (Showing the Annual Turnover of last three years) with their Signature, registration No. & Seal must be submitted along with the bid.

p. Authorization certificate in Annexure-L. L-1, L-2.

q. 2 years Warranty/Guarantee Certificate by Bidder on 100/- Rs Notary stamp paper to be submitted with Bid.

r. All Annexures duly signed with seal.

s. (i) Experience Criteria:-T he Bidder should have regularly supplied same and similar category Machinery, Equipments and tools as per bid items to any Central / State Govt Organization / PSU / Government Undertaking Company for last 3 Financial years before the bid opening date. Copies of relevant contracts to be submitted along with bid in support of having supplied some quantity during the last three Financial year. For fulfilling the experience criteria any one of the following documents may be considered as valid proof (a) Purchase Order copy along with Invoice(s) with self-certification by the bidder that supplies against the invoices have been executed. (b) Execution / Completion certificate by concerned buyer with order value and purchase order.

(ii) The Bidder should have executed a single order atleast 80 Lacs. for same or similar category Machiney, Equipments and tools as per Bid items in at least one of the last three financial years (2021-22,2022-23,2023-24) to any Central / State Govt Organization/PSU /Government Undertaking Company. For fulfilling the Past Experience criteria any one of the following documents may be considered as valid proof (a) Purchase Order copy along with Invoice(s) with self-certification by the bidder that supplies against the invoices have been executed. (b) Execution / Completion certificate by concerned buyer with order value and purchase order.

Buyer can ask to verify all the orders and received payment details which are submitted in the bid.

t. Bidders should provide details of service centre and information on service support facilities that would be provided after the warranty period. Manufacturer should have trained and qualified customer support staff with ample experience in the required field.

Signature of tenderer with seal

u. DTE Rajasthan PERFORMANCE CLAUSE: If bidder had received purchase order from buyer's department in last three financial years, they have to submit the details with Purchase order and Invoice. Buyer can check the bidder's past performance in this Department. Such performance can be evaluated by the buyer and can accept or reject bid on this basis.

v. The bidder of the offered products must have valid ISO certification ISO 9001:2015, 14001:2015, 45001:2018 up to bid validity.

w. The bidder is required to submit the proof of registration as follows :-

Type of Company/ Firm	**Copy of Certificate required**
Company (under Companies Act)	Valid Certificate of Incorporation
Proprietorship Firm	Shop & Establishment Certificate or Professional Tax Certificate.

Partnership Firm	Partnership registration certificate of registered deed of partnership
Limited Liability Partnership	Valid Certificate of Incorporation

Note: The bidder must upload scanned copies of all the originally downloaded documents (Duly filled and seal-signed) of this tender only.

9. In absence of the above or wrongly placing the required documents in any other cover or not mentioning the desired information at the specified place/ column, the bid may not be considered and will be rejected. The provisions of RTPP Rules 2013 & RTPP Act 2012 and Finance Department, Government of Rajasthan, orders and circulars will prevail in this regard.

(B) FINANCIAL BID (Second cover-xls) :

It should contain details of price quoted in BOQ.

Note:- The Financial bid of only Technically qualified bidders will be opened. The date of opening of financial bid will be displayed on www.eproc.rajasthan.gov.in .

(i) Bid Evaluation Criteria(Selection Method) is Least Cost Based Selection (LCBS)-L1Bidder with the **lowest cumulative value** of the financial bid i.e. **(Lowest financial cost after adding the cost of all the items)** shall be declared as L1 bid.

(ii)Pre-dispatch Inspection will be carried out from the representative of this Directorate, if required by the Department. However, inspection charges will be borne by the bidder.

(iii) Bidder has to quote all the items in the bid. Evaluation will be done on the total tender value wise. NQ or Zero quoted in the BoQ will lead to rejection of bid.

(iv) The bid will be evaluated on total value of the bid and lowest bid (i.e. L-1) will be considered for placing supply order.

10. The tenderers shall quote F.O.R. destination prices only. indicating the Freight inclusive of unloading and stacking and Insurance charges in Financial/Price Bid/BOQ.They will also indicate the prevailing rates of G.S.T (exclusive) in the quoted prices. If the Financial/Price Bid/BOQ is not filled completely, the offer is likely to be ignored.
11. Material/Equipment on order shall be required to be dispatched on "Freight paid basis".
12. Before electronically submitting the tenders, it should be ensured that all tender documents enlisted above including conditions of contract are signed & sealed on each & every page by the authorized representative of the firm after filling requisite information/details desired in the specification & Qualifying Requirement.

Signature of tenderer with seal

13. All tenders, in which any of the prescribed conditions are not fulfilled or which have been vitiated by errors in calculations, totaling or other discrepancies or which contain over writing in figures or words or corrections not initialed and dated, may be liable to rejection.
14. The supplier/ contractor shall furnish particulars to the payment making authorities of DTE in prescribed format to be provided by the purchaser. **(Annexure- J)**
15. No conditional tenders shall be accepted and will be rejected summarily forthwith.
16. The DTE reserves the right to cancel the tender at any time without assigning any reasons. The DTE does not bind himself to accept the lowest or any tender or any part of the tender and shall not assign any reason(s) for the rejection of any tender or a part thereof.
17. No refund of tender fee is claimable for tenders not accepted or forms not submitted.

18. Payment of Bill will be made by **Director (Education), Technical Education, Jodhpur** after the receipt of material and found to entire satisfaction and as per specification and good conditions mentioned there in supply order.
19. The supply will be accepted only on working day in the office working hours.
20. The Tenderer would provide Guarantee for an appropriate period from the date of delivery of the said goods in good conditions. During Course of Guarantee period, the items will have to got replaced FREE OF COST at Concerning Institute.
21. Quantity of items can be increased/decreased/cancelled. Department is competent to accept/refuse the Tender/Tenders without quoting any reason thereof.
22. **All applicable statutory deductions regarding GST, income tax etc. are to be made from the suppliers bill.**
23. All other Terms and conditions of GF&AR and Rajasthan Transparency in Public Procurement Act, 2012, Rajasthan Transparency in Public Procurement Rule, 2013 and Finance Department, Government of Rajasthan, orders and circulars shall be applicable.

Enclosed : As Above

DIRECTOR (EDUCATION)
TECHNICAL EDUCATION RAJASTHAN
JODHPUR

Signature of tenderer with seal

GOVERNMENT OF RAJASTHAN
DIRECTORATE OF TECHNICAL EDUCATION RAJASTHAN, JODHPUR
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"CONDITIONS OF TENDER AND CONTRACT FOR OPEN TENDER"

Note : Tenderers should read these conditions carefully and comply strictly while sending their tenders.

1. Tenders are hereby invited in e-tender system for purchase of Electrical Lab Items. Tenders are to be submitted online in electronic format on website http://eproc.rajasthan.gov.in. The tender document/specification can be downloaded from above mentioned website

2.1 Any change in the constitution of the firm, etc. shall be notified forthwith by the contractor in writing to the purchase officer and such charge shall not relieve any former member of the firm, etc. from any liability under the contract.

2.2 No new partner/partners shall be accepted in the firm by the contractor in respect of the contract unless he/they agree to abide by all its terms, conditions and deposit with the purchase officer a written agreement to this effect. The contractors receipt for acknowledgement or that of any partners subsequently accepted as above shall bind all of them and will be sufficient discharge for any of the purpose of the contract.

3. Tenderer will have to submit copy of GST Registration Certificate duly attested by the Tenderer without which tender may not be considered.

4. Tenderer will have to submit copy of PAN CARD duly attested by the Tenderer without which tender may not be considered.

5. Tender forms shall be filled in ink or typed. No Tender filled in pencil shall be considered. The Tenderer shall sign the Tender form at each page and at the end including amendment sheet enclosed in token of acceptance of all the terms and conditions of the tender.

6. Rate shall be written both in Words and Figures. There should not be errors and or over writing. Correction if any, should be made clearly and initialed with dates. The Rates should mention element of the G.S.T. separately.

7. The tenderers shall quote F.O.R. destination prices only. indicating the Freight inclusive of unloading and stacking and Insurance charges in Financial/Price Bid/BOQ. They will also indicate the prevailing rates of G.S.T (exclusive) in the quoted prices. If the Financial/Price Bid/BOQ is not filled completely, the offer is likely to be ignored.

Signature of tenderer with seal

8. 8.1 Preference to Local Industries Registered with the Director of Industries. Rajasthan, Jaipur over the Tendering Units, outside the State of Rajasthan as per the policy approved by the government will be operative.

8.2 Under the different situations between local tendering unit of S.S.I. Rajasthan and outside the State of Rajasthan the policy as laid down by the Government will be operative & rule amended up to date shall be applicable. (Amended vide Finance Department Order No. F-15 (1) FD/CSPO/9608/2000 Date 21/03/2000).

9. **VALIDITY:** Tenders shall be valid for a period of **90 days** from the date of opening of Tender.

10. The approved supplier shall be deemed to have carefully examined the conditions, specifications, size, Make and drawings, etc. of the goods to be supplied. If he has any doubts as to the meaning of any portion of these conditions or of the specifications, drawing, etc. he shall before signing the contract, refer the same to the purchase officer and get clarification

11. The contractor shall not assign or sublet his contract or any substantial part thereof to any other agency.

12.1 **SPECIFICATIONS:** All article supplied shall strictly confirm to specifications. Those articles should confirm strictly to those specification as mentioned in Schedule-'H".

12.2 The supply of articles marked with a struck/at serial number shall in addition, conform strictly to the approved samples (if demanded during technical evaluation).The supply shall be of the very best quality. The supply of articles should be in accordance with the samples. If any discrepancy, the decision of the buyer shall be final and binding on the tenderers.

13.1 WARRANTY/GUARANTEE CLAUSE : The Tenderer would give guarantee that the goods/stores/ articles would continuous to confirm to the description and quality as specified for a minimum period of **24 Months** from the date of delivery of the said goods/ stores/articles to be purchased and that not withstanding the fact that the purchasing entity may have inspected and/or approved the said good/stores if during the aforesaid period of 24 months. The said goods/stores/articles to discovered to confirm to the description and quality aforesaid or have determined (and the decision of the buyer in that behalf will be final and conclusive). The procuring entity will be entitled to reject the said goods/stores/articles or such portion thereof as may be discovered not to confirm to the said description and quality, on such rejection the goods/articles/stores will be at the seller's risk and all the provision relating to rejection of goods. etc. shall apply. The tenderer shall if so called upon to do replace the goods, etc. or such portion there of as is rejection by the purchase committee, otherwise the tenderer shall pay such damage as may arise by reason of the breach of the condition here in contained. Nothing here in contained shall prejudice any other right of the purchase officer in that behalf under this or otherwise.

Signature of tenderer with seal

13.2 In case of machinery and equipment also guarantee will be given as mentioned in clause 13 (i) above and the tenderer shall during the guarantee period replace the parts if any remove any manufacturing defect if found during the above period so as to make machinery and equipment operative. The Tenderer shall also replace machinery and equipments in case it is found defective which cannot be put to operations due to manufacturing defect etc.

13.3 In case of machinery and equipment specified by the purchase officer the tenderer shall be responsible for carrying out annual maintenance and repairs on the terms and conditions as may be agreed. The Tenderer shall also be responsible to ensure adequate regular supply of spare parts needed for as specific type of machinery and equipment whether under their annual maintenance and repairs rate contract or otherwise. In case of change of model he will give sufficient notice to the purchase officer who may like to purchase spare parts from them to maintain, the machinery and equipment in perfect condition.

14.1 INSPECTION: Pre-dispatch Inspection will be carried out from the representative of this Directorate, if required by the Department. However, inspection charges will be borne by the bidder.

14.2 The tenderer shall furnish complete address of the premises of his office, godown and workshop where inspection can be made together with name and address of the person who is to be contacted for the purpose. In case of those dealers who have newly entered in business a letter of introduction from their bankers will be necessary.

15. SAMPLES: If required, the bidder will have to submit samples of items after opening of technical bid on demand, this will be part of technical evaluation.

16. Each samples shall be marked suitable either by written on the sample or on a slip or durable paper securely, fastened to the sample the name of the tenderer and serial number of the item, of which it is a sample in the schedule.

17. Approved samples would be retained free of cost up to the period of six month after the expiry of the contract. The government shall not be responsible for any damage, wear and tear or loss during testing, examination etc. during the period these samples are retained. The samples shall be collected by the tenderer on the expiry of the stipulated period. The Government shall in no way make arrangements to return the samples. The samples uncollected within 9 months after expiry of contract shall be forfeited by the government and no claim for their cost etc. shall be entertained.

18. Sample not approved shall be collected by the unsuccessful tenderers. The government will not be responsible for any damage, wear and tear or loss during testing examination etc. During the period these samples are retained. The uncollected samples shall be forfeited and no claim for their cost etc. shall be entertained.

Signature of tenderer with seal

19. 19.1 REJECTION : Article not approved during inspection shall be rejected and will have to be replaced by the tenderer at his own cost within the time fixed by the buyer.

19.2 If however due to exigencies of government work, such replacement either in whole or in part, is not considered feasible, the purchase officer after giving a opportunity to the tenderer of being heard shall for reasons to be recorded, deduct a suitable amount from the approved rates. The deduction so made shall be final.

20. The rejected articles shall be removed by the tenderer within 15 days of intimation of rejection after which purchase officer shall not be responsible for any loss, shortage or damage and shall have the right to dispose of such articles as he thinks fit, at the tenderer risk and on his account.

21. The tenderer shall be responsible for the proper packing so as to avoid damage under normal condition of transport by sea, rail and road or air and delivery of the material in good condition to be consignee at destination. In the event of any loss and breakage or leakage or any shortage the tender shall be liable to make good such loss and shortage found at the check/inspection of the materials by the consignee. No extra cost on such account shall be admissible.

22. The contract for the supply, can be repudiated at any time by the purchase officer, if the supplies are not made to his satisfaction after giving an opportunity to the tenderer of being heard and recording of the reasons for repudiation.

23. Direct or Indirect canvassing on the part of the tenderer or his representative will result in disqualification.

24. 24.1. **DELIVERY PERIOD**

The Tenderer whose tender is accepted shall arrange supplies within a period as mentioned below from the date of supply order-

S.No.	Items	Quantity	Delivery Period
	As per Bid		**Up to 40 days**

24.2. At the time of award of contract, the quantity of goods, works or services originally specified in the bidding documents may be increased/decreased, but such increase shall not exceed 50% of the quantity specified in the bidding documents. It shall be without any change in the unit prices or other terms and conditions of the bid and the bidding documents.

24.3 If the procuring entity does not procure any subject matter of procurement or procures less than the quantity specified in the bidding documents due to change in circumstances, the bidder shall not be entitled for any claim or compensation except otherwise provided in the bidding documents.

24.4 Repeat orders for extra items or additional quantities may be placed on the rates and conditions given in the contract. Delivery or completion period may also be proportionately increased. The limits of repeat order is 50% of the value of original contract shall not be exceeded in any case.

25. 25.1 EARNEST MONEY: Tender shall be accompanied by an earnest money as mentioned in tender document, without which tenders will not be considered.

Signature of tenderer with seal

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25.2 REFUND OF EARNEST MONEY : The Earnest Money of unsuccessful tenderers shall be refunded soon after a final acceptance of tender.

25.3 PARTIAL EXEMPTION FROM EARNEST MONEY :- Firms which arc registered with Director of Industries, Rajasthan shall furnish the amount of earnest money in respect of items for which they are registered as such subject to their furnishing registration certificate in original or Self Attested Photostat copy issued from the Director of Industries, Rajasthan at the rate of 0.5 % of the estimated value of the tender shown in N.I.T. and as per RTPP Act 2012 and Rules 2013 and finance order and circulars.

25.4 The Central Government and Government of Rajasthan under taking need not furnish any amount of earnest money.

25.5The earnest money/security deposit lying with the department/office in respect of other tenders awaiting approval or rejected or on account of contracts being completed will not be adjusted towards Earnest Money/Security Money for the fresh tenderer.

26. **FORFEITURE OF EARNEST MONEY(as per declaration) :** the Earnest Money will be forfeited in the following cases :

i. When tenderer withdrawls or modifies the offer after opening of tender but before acceptance of tender.

ii. When tenderer does not execute the agreement, any other formality require by Department, if any, prescribed within the specified time.

iii. When tenderer does not deposit the performance security Money after the supply order is given.

iv. When he fails to commence the supply of the items as per supply order within the time prescribed.

v. If the bidder breaches any provision of code of integrity prescribed for bidders specified in the Act and chapter VI of RTPP rules 2013.

Signature of tenderer with seal

AGREEMENT AND SECURITY DEPOSIT (Performance Security) :-

27.1 i. Successful tenderer will have to execute an agreement in the **Form 17** (on non-judicial Stamp Paper of the value Rs. 500/-or as per finance order within a period of 15 days of issue of order and deposit security equal to 5 % of the value of the stores for which tenders are accepted within 15 days from the date of dispatch on which the acceptance of the tender is communicated to him and as per finance order.

ii. No interest will be paid by the department on the security money.

iii. The Earnest Money deposited at the time of tender will be adjusted towards security amount. The security money amount shall in no case be less than the Earnest Money.

iv. Performance security shall be furnished in any one of the following forms-

a. Bank Draft or Banker's Cheque or Bank Guarantee of a scheduled bank.

b. National Savings Certificates and any other script/instrument under National Savings Schemes for promotion of small savings issued by a Post Office in Rajasthan, if the same can be pledged under the relevant rules. They shall be accepted at their surrender value at the time of bid and formally transferred in the name of procuring entity with the approval of Head Post Master.

c. Fixed Deposit Receipt (FDR) of a scheduled bank. It shall be in the name of procuring entity on account of bidder and discharged by the bidder in advance. The procuring entity shall ensure before accepting the Fixed Deposit Receipt that the bidder furnishes an undertaking from the bank to make payment/premature payment of the Fixed Deposit Receipt on demand to the procuring entity without requirement of consent of the bidder concerned. In the event of forfeiture of the performance security, the Fixed Deposit shall be forfeited along with interest earned on such Fixed Deposit.

d. Any other instrument as mentioned in Rajasthan Transparency in Public Procurement Rules 2013.

e. deposit through eGRAS.

v. Performance security furnished in the form specified in clause (a) to (d) of sub-rule {27.1(iv)} shall remain valid for a period of sixty days beyond the date of completion of all contractual obligations of the bidder, including warranty obligations and maintenance and defect liability period.

27.2 FORFEITURE OF SECURITY DEPOSIT: Security amount in full or part may be forfeited in the following cases :

a. When any Terms and conditions of the contract is breached.

b. When the Tenderers fails to make complete supply satisfactorily.

c. Notice of reasonable time will be given in case of forfeiture of security deposit. The decision of the purchase officer in this regard shall be final.

Signature of tenderer with seal

28. INSURANCE

i. The goods will be delivered at the destination godown in prefect condition. The supplier, if he so desired may be insure the valuable goods against lost by theft destruction or damage by fire, flood under exposure to whether or otherwise viz. (war rebellion, riot etc.) The insurance charges will be borne by the supplier and state will not be required to pay such charges, if incurred. The supplier is required to get the goods insured till 30 days after delivery.

ii. The articles may also be got insured at the cost of the purchaser if so desired by the purchaser. In such cases, the insurance should invariably be with life Insurance Corporation of India or its subsidiaries or as per rules.

29. PAYMENTS :

i. Advance payment will not be made.

ii. Unless otherwise agreed between the parties, payment for the delivery of the stores will be made on submission of bill in the proper form by the tenderer to the purchase officer in accordance with G.F. & A.R. all remittance charges will be borne by the tenderer.

30.1 The time specified for delivery in the Tender form shall be deemed to be the essence of the contract are the successful tenderer shall arrange supplies with in the period on receipt of the firm order from the purchase office.

30.2 a. Delay up to the one fourth period of the prescribed delivery period. **2.5 %**

b. Delay exceeding one fourth but not exceeding half of the prescribed period. **5.0 %**

c. Delay exceeding half but not exceeding three fourth of the prescribed period. **7.5 %**

d. Delay exceeding three fourth of the prescribed period. **10 %**

30.3 Fraction of a day reckoning period of delay in supplies shall be eliminated if it is less than half a day.

30.4 The maximum amount of liquidated damages shall be 10%.

30.5 If the supplier requires an extension of time in completion of contractual supply on account of occurrence of any hindrance, he shall apply in writing to the authority, which has placed the work-order for the same immediately on occurrence of the hindrance but not after the stipulated date of completion of supply.

30.6 Delivery period may be extended with or without liquidated damages if the delay in the supply of goods is on account of hindrances beyond the control of the tenderer.

Signature of tenderer with seal

31. RECOVERIES :

Recoveries of liquidated damages short supply breakage, rejected articles shall ordinary be made from bills. Amount may also be withheld to the extent of short supply breakages, rejected articles and in case of failure in satisfactory replacement by the supplier along with amount of liquidated damages shall be recovered from his dues and the security deposit available with the department. In case recovery is not possible recourse will be taken under Rajasthan PDR Act. or any other law in force.

32. Tenderers must make their own arrangement to obtain import license if necessary.

33. If a tenderer imposes conditions which are in addition to or in conflict with the conditions mentioned in his tender is liable to summary rejection. In any case none of such conditions will be deemed to have been accepted unless specifically mentioned in the letter of acceptance of tender issued by the purchase officer.

34. The purchase committee/ procurement entity reserves the right to accept any tender not necessarily the lowest, reject any tender without assigning any reasons.

35. If any dispute arise out of the contract with regard to the interpretation, meaning and breach of the term of the contract, the matter shall be referred to by the parties to the Head of the Department who will appoint his senior most deputy as the sole arbitrator of the dispute who will not be related to this contract and whose decision shall be final.

36. All legal proceedings, if necessary arise to the institute may by any of the parties (Government or contractor) shall have to be lodged in courts situated in Jodhpur, Rajasthan and not elsewhere.

DIRECTOR (EDUCATION)
TECHNICAL EDUCATION RAJASTHAN
JODHPUR

I/We have carefully read and understood above terms and conditions (from 1 to 36) of the tender and abide by them.

I/We have also certify that all the information and catalogue etc. of the tendered item has been enclosed and no information has been held back by us.

SIGNATURE OF THE TENDERER
With seal and designation

ANNEXURE- A 2W2

COMPLIANCE WITH THE CODE OF INTEGRITY AND NO CONFLICT OF INTEREST

Any person participating in a procurement process shall –

a) not offer any bribe reward or gift or any material benefit either directly or indirectly in exchange for an unfair advantage in procurement process or to otherwise influence the procurement process.

b) not misrepresent or omit that mislead or attempts to mislead so as to obtain a financial or other benefit or avoid an obligation.

c) not indulge in any collusion, Bid rigging or anti-competitive behavior to impair the transparency, fairness and progress of the procurement process.

d) not misuse any information shared between the procuring entity and the Bidders with an intent to gain unfair advantage in the Procurement process.

e) not indulge in any coercion including impairing or harming or threatening to do the same, directly or indirectly, to any party or to its property to influence the Procurement process.

f) not obstruct any investigation or audit of a Procurement process.

g) disclose conflict of interest, if any and

h) disclose any previous transgressions with any Entity in India or any other country during the last three years or any debarment by any other procuring entity.

CONFLICT OF INTEREST :

The Bidder participating in a bidding process must not have a conflict interest.

A conflict of interest is considered to be a situation in which a party has interests that could improperly influence that party's performance of official duties or responsibilities, contractual obligations, or compliances with applicable laws and regulations.

A Bidder may be considered to be in conflict of interest with one or more parties in a bidding process if, including but limited to :

a) have controlling partners/shareholders in common; or

b) receive or have received any direct or indirect subsidy from any of them; or

c) have the same legal representative for purposes of the Bid; or

d) have a relationship with each other, directly or through common third parties, that puts them in a position to have access to information about or influence on the Bid of another Bidder or influence the decision of the Procuring Entity regarding the Bidding process; or

e) the Bidder participates in more than one Bid in a bidding process. Participation by a Bidder in more than one Bid will result in the disqualification of all Bids in which the bidder is involved. however, this does not limit the inclusion of the same subcontractor, not otherwise participating as a Bidder, in more than one Bid; or

f) the Bidder or any of its affiliates participated as a consultant in the preparation of the design or technical specifications of the Goods, Works or Services that are the subject of the Bid; or

g) Bidder or any of its affiliates has been hired (or to proposed to be hired) by the Procuring Entity as engineer-in charge/consultant for the contract

Signature of tenderer with seal

ANNEXURE- B

DECLARATION BY THE BIDDER REGARDING QUALIFICATIONS

In relation to my/our Bid submitted to ..... for procurement of ..... in response to their notice inviting Bid No. ..... Dated ..... I/We hereby declare under Section 7 of Rajasthan Transparency in Public Procurement Act, 2012, that;

01. I/we possess the necessary professional, technical, financial and managerial resources and competence required by the Bidding Document issued by the Procuring Entity;

02. I/we have fulfilled my/our obligation to pay such of the taxes payable to the Union and the State Government or any local authority as specified in the Bidding Documents;

03. I/we are not insolvent, in receivership, bankrupt or being wound up, not have my/our affairs administered by a court or a judicial officer, not have my/our business activities suspended and not the subject of legal proceedings for any of the foregoing reasons;

04. I/we do not have, and our directors and officers not have, been convicted of any criminal offence related to my/our professional conduct or the making of false statements or misrepresentations as to my/our qualifications to entire to a procurement contract within a period of three years preceding the commencement of this procurement process, or not have been otherwise disqualified pursuant to debarment proceedings;

05. I/we do not have conflict of interest as specified in the Act, Rules and the Bidding Document, which materially affects fair competition;

Date :

Place :

Signature of Bidder with seal

Name :

Designation :

Address :

Aadhar No:-

e-mail Address:-

ANNEXURE- C

GRIEVANCE REDRESSAL DURING PROCUREMENT PROCESS

The Designation and address of the First Appellate Authority is **Director (Education), Directorate of Technical Education Rajasthan, Jodhpur.**

The Designation and address of the Second Appellate Authority is **Secretary, Technical Education Rajasthan, Jaipur.**

01. **Filing an appeal**

If a Bidder or prospective bidder is aggrieved that any decision, action or omission of the Procuring Entity is in contravention to the provision to the provision of the Act or the Rules or the Guidelines issued there under, he may file an appeal to first Appellate Authority, as specified in the Bidding Document within a period of ten days from the date of such decision or action, omission, as the case may be, clearly giving the specific ground or grounds on which he feels aggrieved.

Provided that after the declaration of a Bidder as successful the appeal may be filed only by a Bidder who has participated in procurement proceedings.

Provided further that in case a procuring Entity evaluates the Technical Bids before the opening of the Financial Bids, an appeal related to the matter of Financial Bids may be filled only by a Bidder whose Technical Bid is found to be acceptable.

02. The officer to whom an appeal is filled under para (1) shall deal with the appeal as expeditiously as possible and shall Endeavour to dispose it of within thirty days from the date of the appeal.

03. If the officer designation under para (1) fails to dispose the appeal filed within the period specified in para (2), or if the Bidder or prospective bidder or the Procuring Entity is aggrieved by the order passed by the First Appellate Authority, the Bidder or prospective bidder or the Procuring Entity, as the case may be, may file a second appeal to Second Appellate Authority specified in the Bidding Document in this behalf within fifteen days from the expiry of the period specified in para (2) or of the date of receipt of the order passed by the First Appellate Authority, as the case may be.

04. **Appeal not to lie in certain cases**

No appeal shall lie against any decision of the Procuring Entity relating to the following matters, namely :

a) determination of need of procurement;

b) provisions limiting participation of Bidders in the Bid process;

c) the decision of whether or not to enter into negotiation;

d) cancellation of a procurement process;

e) applicability of the provisions of confidentiality.

05. **Form of Appeal**

a) An appeal under para (1) or (3) above shall be in the annexed Form along with as many copies as there are respondents in the appeal.

Signature of tenderer with seal

AU2

b) Every appeal shall be accompanied by an order appealed against, if any, affidavit verifying the facts stated in the appeal and proof of payment of fee.

c) Every appeal may be presented to First Appellate Authority or Second Appellate Authority, as the case may be, in person or through registered post or authorized representative.

06. **Fee of filing appeal**

a) Fee for first appeal shall be rupees two thousand five hundred and second appeal shall be rupees ten thousand, which shall be non-refundable.

b) The fee shall be paid in the form of bank demand draft or banker's cheque of a Scheduled Bank in India payable in the name of Appellate Authority concerned.

07. **Procedure for disposal of appeal**

a) The first Appellate Authority or Second Appellate Authority, as the case may be, upon filing of appeal, Shall issue notice accompanied by copy of appeal, affidavit and documents, if any, to the respondents and fix date of hearing.

b) On the date fixed for hearing, the First Appellate Authority or Second Appellate Authority, as the case may be shall,-

(i) here all the parties to appeal present before him; and

(ii) peruse or inspect documents, relevant records or copies thereof relating to the matter.

c) After hearing the parties, perusal or inspection of documents and relevant records or copies thereof relating to the matter, the Appellate Authority concerned shall pass an order in writing and provide the copy of order to the parties to appeal free of cost.

d) The order passed under sub-clause (c) above shall also be placed on the State Public Procurement Portal.

Signature of tenderer with seal

FORM No.1 [See rule 83] 252

MEMORANDUM OF APPEAL UNDER THE RAJASTHAN TRANSPARENCY IN PUBLIC PROCUREMENT ACT, 2012

Appeal No. ..... of .....

Before the .....(First/Second Appellate Authority)

01. Particulars of appellant :

(i) Name of Appellant :

(ii) Official address, if any :

(iii) Residential address :

02. Name and address of the respondent(s) :

(i)

(ii)

(iii)

03. Number and date of the order appealed against and name and designation of the officer/authority who passed the order (enclosed copy), or a statement of a decision, action or omission of the Procuring Entity in contravention to the provisions of the act by which the appellant is aggrieved :

04. If the Appellant proposes to be represented by a representatives, the name and postal address of the representative :

05. Number of affidavits and documents enclosed with the appeal :

06. Ground of appeal :

.....

.....

.....

(supported by an affidavit)

07. Prayer

:.....

.....

.....

Place : .....

Date : .....

Appellant's Signature

ANNEXURE- D

ADDITIONAL CONDITIONS OF CONTRACT

01. **Correction of arithmetical errors :**

Provided that a Financial Bid is substantially responsive, the Procuring Entity will correct arithmetical errors during evaluation of Financial Bids on the following basis :

(i) if there is discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Procuring Entity there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected.

(ii) if there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected; and

(iii) if there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (i) and (ii) above.

If the Bidder that submitted the lowest evaluated Bids does not accept the correction of errors, its Bid shall be disqualified and its Bid Security shall be forfeited or its Bid Securing Declaration shall be executed.

02. **Procuring Entity's Right to Vary Quantities :**

(i) At the time of award of contract, the quantity of goods, works or services originally specified in the Bidding Document may be increased or decreased by a specified percentage, but such increase or decrease shall be as per RTPP RULE.

(ii) If the Procuring Entity does not procure any subject matter of procurement or procures less than the quantity specified in the Bidding Document due to change in circumstances, the Bidder shall not be entitled for any claim or compensation except otherwise provided in the Conditions of Contract.

(iii) In case of procurement of Goods or services, additional quantity may be procured by placing a repeat order on the rates and conditions of the original order. However, the additional quantity shall not be more than 50% of the value of Goods of the original contract and shall be within one month from the date of expiry of last supply, if the suppliers fails to do so, the Procuring Entity shall be free to arrange for the balance supply by limited Bidding or otherwise and the extra cost incurred shall be recovered from the Suppliers.

03. **Dividing quantities among more than one Bidder at the time of award (In case of Procurement of Goods) :**

As a general rule all the quantities of the subject matter of procurement shall be procured from the Bidder, whose Bid is accepted. However, when it is considered that the quantity of the subject matter of procurement to be procured is very large and it may not be in the capacity of the Bidder, whose Bid is accepted, to deliver the entire quantity or when it is considered that the subject matter of procurement to be procured is of critical and vital nature, in such cases, the quantity may be divided between the Bidder, whose Bid is accepted and the second lowest Bidder or even more Bidders in that order, in a fair, transparent and equitable manner at the rates of the Bidder, whose Bid is accepted.

Signature of tenderer with seal

ANNEXURE-E

"DECLARATION BY THE TENDERERS" (S.R. 11)

I / We declare that I am ..... / We are bonafide /Manufacturer/Whole Sellers/ Sole Distributors/ Authorized Dealer/ Dealers/ Sole Selling/ Marketing Agent in the Good/Stores/Equipments/Furniture's for which I/We have Tendered. **(STRIKE OFF WHICHEVER IS NOT APPLICABLE)**

If, this Declaration is found to be incorrect then without prejudice to any other action that may be taken, my/our security may be forfeited in full and the Tender if any to the extent accepted may be cancelled.

SIGNATURE OF THE TENDERER

With seal and designation

ANNEXURE- F 2/12

"G.S.T. DECLARATION"

I, Certify that the goods on which **G.S.T.** has been charged have not been exempted under the **G.S.T. Act,** or the Rules made there under and the amount charged on account of **G.S.T.**. is not more than what is payable under the relevant provisions of the **G.S.T.** Act or the Rules made there under.

Certify that we M/s .... are registered as Manufacturer/Dealer in the ..... (State or Union Territory) under **G.S.T.** Registration No. .....

SIGNATURE OF THE TENDERER
With seal and designation

ANNEXURE- G dilk

PRICE CHARGING CERTIFICATE

I/We hereby certify that the rate offered in Financial bid are reasonable and justified and we are not marketing lower rates to other department on condition of the tender and contract.

SIGNATURE OF THE BIDDER
WITH SEAL AND DESIGNATION

Annexure-I (If Applicable) 2112

FORMAT OF AFFIDAVIT

(On non-judicial Stamp Paper of Rs- 50/-)

I ..... S/o .....
Aged ..... Years ..... Residing at .....
Proprietor/Partner/Director of M/s ..... do
hereby solemnly affirm and declare that :

a) My/Our above noted enterprise M/s ..... has been issued acknowledgement of Entrepreneurial memorandum Part-II by the District Industries Centre ..... The acknowledgement No is ..... Dated ..... and has been issued for manufacturer of following items :

(i)

(ii)

(iii)

(iv)

(v)

b) My/Our above noted acknowledgement of Entrepreneurial memorandum Part-II has not been cancelled or withdrawn by the Industries Department and that the enterprise is regularly manufacturing the above items.

c) My/Our enterprise is having all the requisite plant and machinery and is fully equipped to manufacture the above noted items.

Place :

Signature of Proprietor/ Director
Authorised Signatory with Rubber Stamp & Date

(ATTESTED BY FIRST CLASS MAGISTRATE OR NOTARY PUBLIC)

Annexure-J

REAL TIME GROSS SETTLEMENT (RTGS) / NATIONAL ELECTRONIC FUND TRANSFER (NEFT)

From: M/s. .....
.....
.....

To,

The Director (Education),
Directorate of Technical Education Rajasthan,
Jodhpur.

Sub:- RTGS / NEFT Payments.

We refer to remittance of our payments using RBI's RTGS/NEFT. Our payments may be made through the above system to our under noted account at our cost :-

Name of Firm	:	
Full Address	:	
Mobile Number	:	
mail ID for Payment Information	:	
Email Address	:	
PAN Number	:	
Bankers Name	:	
Branch Name	:	
9 Digit Code of Bank (Appearing on the MICR Cheque issued by the Bank	:	
Account Type with Code	:	
Account Number (as appearing on Cheque Book)	:	
IFSC Code for RTGS	:	

Signature of Bidder
with Stamp & Address

Annexure-K (If Applicable)

FORMAT OF AFFIDAVIT

(On Non-judicial Stamp Paper of Rs. 100/-)

I.....S/o.....Aged..... years, residing at ..... Proprietors/Partner/Director of M/s.....do hereby solemnly declare that:

a. all items tendered by me/us in NIT No. 2/2024-25 as per Column issued by Director(Edu.), Directorate of Technical Education, Jodhpur are included in Entrepreneurial Memorandum part-II/Udhyog Aadhar issued to our firm by the Industries Department of Rajasthan.

b. the rebate in tender fee & earnest money is applicable to our firm as per rules made for SSI **MSME (उद्योग आधार)** units. (as per Government of Rajasthan Order).

c. if any discrepancy is found later our tender will be liable for rejection including forfeiture of earnest money/security money deposit along with any legal action as per the tender terms & conditions.

Place :

Signature of Proprietor/ Director
Authorized Signatory with Rubber Stamp & Date

ANNEXURE-L

Authorisation certificate to be submitted by Principal manufacturer

It is certified that M/s..... (Name & address of tenderer) is our authorized Distributer/ Dealer. They are authorized to submit tender for..... (Name of item(s) as per Schedule-'H' for which the authorization is being given) to Director (Education), Directorate of Technical Education, Jodhpur (Rajasthan) against their Tender Notice No 02/2024-25 Dated- 06-09-.2024 on behalf of us.

The equipment/ Instrument/Machine is guaranteed for the period as mentioned in tender and during the guarantee period the authorized Distributor/Dealer shall replace the parts or rectify any manufacturing defect found in the machine. They are also responsible for after Sale-service during the life time of equipment/instrument/machine. In case of change of authorized Distributor/ Dealer the new authorized Distributor/Dealer will be responsible for guarantee and after sale-service. In case of failure we will be responsible for providing after sale service.

Note:- This authorization certificate should be typed & signed with Contract person Telephone Number, Mobile Number, Email Address by the principal manufacturer on his original letter pad and scanned copy of which must be up loaded with tender otherwise concerned item of the tender will not be considered for technical evaluation.

Signature of Principal Manufacturer with rubber stamp

Name :

Designation :

Address :

Aadhar No:-

e-mail Address:-

ANNEXURE "L-1" MANUFACTURER'S AUTHORIZATION FORM (MAF)

To,
{Tendering Authority}

.....

.....

I/We {Name/Designation}..... hereby declare/ certify that {Name/Designation}..... is herby authorized to sign relevant documents on behalf of the company / firm in dealing with Tender:

He/She is also authorized to attend meetings & submit technical & commercial information/ clarifications as may be requred by you in the course of processing the Bid No 02/2024-25 and Items No ---------- For the purpose of validation, his/her verified signatures are as under.

Yours faithfully

For and on behalf of M/s (Name of the OEM)

(Authorized Signatory)
Name, Designation & Contact No. Aadhar No.
Address: ----------with seal

ANNEXURE "L-2" MANUFACTURER'S AUTHORIZATION FORM (MAF)

To,

Directorate of Technical Education

Jodhpur

Subject : Issue of Manufacturer's Authorization Form (MAF)

Reference No.:

Sir,

a. **We {name and address of the OEM} who are orignal equipment manufactrurers (OEMs) do hereby authorize {M/s .....} who is our Authorized for Name of item..... to bid, negotiate and conclude the contract with you against the aforementioned tender reference for the following Hardware/items(s) manufactured by us for Bid No. 02/2024-25 :**

Item No.	Equipments	Qty.	Unit	Period of Comprehensive OEM Warranty (in yrs.)	Period of end of sale (in months)	Period of end of service (in yrs.)	Period of back to back support (in yrs.)

b. **We undertake to provide Comprehensive OEM warranty for the offered items for the period mentioned above.**

c. **We undertake that the item/items being quoted is/have not been and is/are not likely to be declared end of sale for period mentioned above from the date of bid submission.**

d. **We undertake that the item/items being quoted is/have not been and is/are not likely to be declared end of service for period mentioned above from the date of bid submission.**

e. **We undertake that items offered by the bidder for back to back support, updates and patches for period mentioned above .**

Yours faithfully

For and on behalf of M/s (Name of the OEM)

(Authorized Signatory)

Name, Designation & Contact No. Aadhar No.

Address: ----------with seal

ANNEXURE – M : PROPOSAL FORMAT FOR ORGANIZATION

Selection A: Organization Profile

i. **Name of the Organization :**

.....

ii. **Registered Address :**

.....

(Necessary fill Tel., Fax.,

.....

Email, Website, etc.

.....

.....

iii. **Legal Status**

S.no	Particulars	Registration no.	Date
1	Public Charitable Trust Act		
2	Society under Societies Registration Act		
3	Non-profit company under Indian Companies Act 1956		
4	Registration under Foreign Contribution (Regulation) Act, 1976		
5	Income tax registration:		
	Under Section 12 A		
	Under Section 80 G		
	Under Section 35 CCA		
	Any other Section/Registration		

iv. **Bank Details:**

Bank Name	Account No.	Date of Opening Account

v. Details of the contract person

Name : .....
Designation : .....
Contact No. : .....
E-mail : .....

vi. Members Associated with the Organization

S.no.	Name	Nationality	Occupation/ qualification	Positions held in the organization	Relationship with any other officer bearers (if any)	Address

Selection B: Operational Background

a. Project related to supply of these type of terms:

S.no	Name of the programme	Period		No of outreach session per month	Details of the Programme	Total Budget	Source of fund
		From	To				

b. Staff Details (Kindly provide the details of 5 key positions in the organization)

Name of Staff	Position	Qualification	Working since

c. Any previous association/working experience with Govt. Sector ? If yes, please provide the details:

d. Volume of Year wise Grant Received during the last 3 years (in different projects):

e. Name of the Donors/Funders during the last 3 Years:

Section C: Basic Documents required to be submitted along with the proposal for Evaluation

a. Copy of Trust Deed if registered under Trust Act.
b. Copy of Memorandum and Rules if registered under Society Registration Act.
c. Annual Report of last one year
d. Audited Accounts of last 3 years
e. Organizational Chart
f. Legal Status of the society-copy of Registration Certificate
g. Copy of PAN/TAN Number
h. Copy of Latest Income Tax Return Filed
i. Any other document relevant to the proposal

Thanking you,

Name of the Bidder:-
Authorized Signatory:-
Seal of the Organization:-
Date:
Place:

ANNEXURE-N : SELF-DECLARATION NO BLACKLISTING

{to be filled by the bidder on Rs. 100/- Non Judicial Stamp}

To,
{Tendering Authority},
_____,
_____,

In response to the Tender/ NIT : for {Project Title}, as an Owner/ Partner/ Director of _____, I/We hereby declare that presently our Company/ firm _____, at the time of bidding, is having unblemished record and is not declared ineligible for corrupt & fraudulent practices either indefinitely or for a particular period of to me by any State/ Central government/ PSU/UT.

If this declaration is found to be incorrect them without prejudice to any other action that may be taken, my/ our security may be forfeited in full and out bid, to the extent accepted, may be cancelled.

Thanking you,

Name of the Bidder:-
Authorized Signatory:-
Seal of the Organization:-
Date:
Place:

ANNEXURE- O : CERTIFICATE OF CONFORMITY/ NO DEVIATION

{to be filled by the bidder on letterhead }

To,
{Tendering Authority},

_____,

_____,

CERTIFICATE

This is to certify that, the specifications of Hardware & Software which I/We have mentioned in the Technical bid, and which I/We shall supply if I/We am/are awarded with the work, are in conformity with the minimum specifications of the tender/ bidding document and that there are no deviations of any kind from the requirement specifications.

Also, I/We have thoroughly read the tender/bidding document and by signing this certificate, we hereby submit our token of acceptance to all the tender terms & conditions without deviations.

I/We are also certify that the price I/We have quoted is inclusive of all the cost factors involved in the end-to-end implementation and execution of the project, to meet the desired Standards set out in the Tender/bidding Documents with contract person Telephone Number, Mobile Number, Email Address

Thanking You,

Name of the Bidder: -
Authorized Signatory: -
Seal of the Organization: -
with contact person Telephone Number, Mobile Number,
Email Address

Date:-
Place:-

ANNEXURE- P : UNDERTAKING ON AUTHENTICITY OF ALL ITEMS and ALLIED EQUIPMENTS

{to be filled by the bidder On letterhead }

To,
{Tendering Authority},
_____,

Reference:

This has reference to the items being supplied/ quoted to you vide our bid ref. no. _____ dated _____

We hereby undertake that all the components/ parts/ assembly/ software used in the equipment shall be genuine, original and new components/ parts/ assembly/ software from respective OEMs of the products and that no refurbished/ duplicate/ second hand components/ parts/ software are being used or shall be used. In respect of licensed operating system, we undertake that the same shall be supplied along with the authorized license certificate with our name/ logo. Also that it shall be sourced from the authorized source for use in India.

In case, we are found not complying with above at the time of delivery or during installation, for the equipment already billed, we agree to take back the equipment already supplied at our cost and return any amount paid to us by you in this regard and that you will have the right to forfeit out EMD/ SD/ PSD/ for this bid or debar/ black list us or take suitable action against us.

Authorized Signatory:-
Name:
Designation:

Annexure-Q

Declaration for correct information

{ To be filled by the Bidder on Rs.- 1000/- Non Judicial Stamp Paper}

To

The Director

Directorate of Technical Education

Jodhpur (Rajasthan).

Subject:- Affidavit of correct information
Ref. Bid No.----------

Dear Sir,

With reference to above mention subject. We hereby declare that, ----------
----------(Name of Firm) our company has furnished the correct information in the tender and we solely responsible for furnishing wrong/false information in the bid.

Thanking you, we remain.

Authorized Signatory

Name :

Designation :

ANNEXURE- R: FINANCIAL BID UNDERTAKING

{on bidder's letterhead in technical bid}

To,

Director (Education),
Directorate of Technical Education Rajasthan,
Jodhpur- 342032

Reference: -

Dear sir,

We, the undersigned bidder, Having read & examined in detail, the Bidding Document, the receipt of which is hereby duly acknowledged, I/we, the undersigned, offer to supply/work as mentioned in the Scope of the work, Bill of Material, Technical specifications, specifications, Service Level Standards & in conformity with the said bidding document for the same.

I/We undertake that the prices are in conformity with the specifications prescribed. The quote/price are inclusive of all cost likely to be incurred for executing this work. The prices are quoted as required in the price-bid given in

I/We undertake, if our bid is accepted, to deliver the goods. In accordance with the delivery schedule specified in the schedule of Requirements.

I/We hereby declare that in case the contract is awarded to us, we shall submit the contract is awarded to us, we shall submit the contract performance guarantee as prescribed in the bidding document.

I/We agree to abide by this bid for a period equal to bid validity and it shall remain binding upon us and may be accepted at any time before the expiry of that period.

Until a formal contract is prepared and executed, this bid, together with your written acceptance thereof and your notification of award shall constitute a binding Contact between us.

I/We hereby declare that out bid is made in good faith, without collusion or fraud and the information contained in the bid is true and correct to the best of our knowledge and belief.

We understand that you are not bound to accept the lowest or any bid you may receive.

We agree to all the terms & conditions as mentioned in the bidding document and submit that we have not submitted any deviations in this regard.

Date:

Authorized Signatory

Name:

Designation:

SELF-DECLARATION **Annexure S**
(To be filled by the bidder)

To,
(Procuring entity)

_____,

In response to the BID Ref. No _____ Dated _____ for (Project Title_____) as an Owner/ Partner/ Director/ Authorized Signatory of _____. I/ We hereby declare that presently our company/ firm_____ at the time of bidding :-

(i) possess the necessary professional, technical, financial and managerial resources and competence required by the Bidding Document issued by the Procuring Entity;
(ii) have fulfilled my our obligation to pay such of the taxes payable to the Union and the State Government or any local authority as specified in the Bidding Document;
(iii) is having unblemished record and is not declared ineligible for corrupt & fraudulent practices either indefinitely or for a particular period of time by any State Central government/ PSU UT.
(iv) does not have any previous transgressions with any entity in India or any other country during the last three years
(v) does not have any debarment by any other procuring entity
(vi) is not insolvent in receivership, bankrupt or being wound up, not have its affairs administered by a court or a judicial officer, not have its business activities suspended and is not the subject of legal proceedings for any of the foregoing reasons,
(vii) does not have, and our directors and officers not have been convicted of any criminal offence related to their professional conduct or the making of false statements or misrepresentations as to their qualifications to enter into a procurement contract within a period of three years preceding the commencement of the procurement process, or not have been otherwise disqualified pursuant to debarment proceedings
(viii) does not have a conflict of interest as mentioned in the bidding document which materially affects the fair competition.
(ix) will comply with the code of integrity as specified in the bidding document, If this declaration is found to be incorrect then without prejudice to any other action that may be taken as per the provisions of the applicable Act and Rules thereto prescribed by GoR, my our security may be forfeited in full and our bid, to the extent accepted, may be cancelled

Thanking you,

Name of the Bidder:
Authorized Signatory:
Seal of the Organization:
Date:
Place:

Annexure "H"
e-Tender No. 02 (2024-2025) ELECTRICAL LAB RELATED ITEMS

TECHNICAL SPECIFICATION

1. The scanned copy of this annexure "H" (original downloaded) duly completed and seal signed by the bidder must be uploaded otherwise bid should not be considered. Any supplementary information may be uploaded separately.
2. Scanned Copies Items wise Original Literature/Leaflets/Catalogue correct Image as per Tender Specification enclosed, Authorization Certificate of manufacturer prescribed format (Annexure-L) etc. must be enclosed in support of your Make and Specifications otherwise concerned items will not be considered for Technical Evaluation.
3. The delivery period up to 40 days.
4. The Material will be Supplied F.O.R. at Jodhpur or Principal Government Polytechnic College, as per order List.
5. Index Page No. 1 & 2 all Document of S. No. 1 to 34 (if applicable) and other required document must be enclosed otherwise concerned Tender will not be considered for Technical Evaluation.
6. All the material supplied should be new and no item can be supplied which is refurnished.

S. No.	Name of Item with Specifications	Bagidora	Hanumangarh	Jalore	Jhunjhunu	Karouli	Nagour	Tonk	Jaisalmer	Dausa	Total	Specify varieations in Specifications in any, otherwise write "No variation"/ as per Specification & write Make & Model
1.	**Colour Digital Storage Oscilloscope 100mhz 1gs/S With FFT** **Specifications** **Horizontal** •Bandwidth : DC - 100MHz •Channels : 2 •Bandwidth Limits : 20MHz (-3dB) •Sample Rate : 1GS/s •Sample Mode : Real Time •Sample Memory Dept: 40 K •Time base range : 4ns/div~80s/div	2	0	0	0	1	0	0	0	0	3	

	•Time base accuracy : ±50ppm •Display Type : 7 inch LCD color (800X 480 pixels) •Display Language : English Input •Mode : Sample, peak detect, averaging •Input coupling : DC, AC, GND, •Input impedance : 1MΩ ± 2% in parallel with 20pF ± 3pF •Probe attenuation factors: 1X, 10X, 100X, 1000X •Maximum input voltage: 300 VRMS (420V pk-pk ~ CAT I & CAT II) Vertical •Vertical resolution : 8 bits •Vertical sensitivity : 2mV/div~5V/div (input to BNC) •Rising time (typical on BNC) : 3.5nS •Accuracy : ± 3% **Trigger** •Trigger Source : Ch1, CH2, Line, External •Trigger Modes : Auto, Normal, Single, Edge •Trigger Coupling : AC, DC, LF Reject, HF Reject •Trigger Sensitivity : DC to 100MHz: 200mV •Trigger Level Range from Center of Screen : CH1,CH2 : ±8 Division **Interface** •USB **Measurement system** •Automatic measurement												

	Frequency, Period, Mean, Pk-Pk, Cyclic RMS, Minimum, Maximum, Rise Time, Fall Time, +Pulse width, -Pulse width, Delay 1-2 Rise, Delay 1-2 Rise, Delay 1-2 Fall, +Duty,-Duty, Vbase, Vtop,Vmid,Vamp, Overshoot, Preshoot, Preiod Mean, Preiod RMS, FOVShoot, RPREShoot, BWIDTH, FRF, FFR,LRR,LRF,LFR,LFF •Waveform math : +,-, x,÷ •Waveform storage : 10 waveform, 10 setups •Lissajou's figure : Available •FFT window : Hanning, hamming, blackman, rectangle •FFT acquisition points : 1024 points **Power Supply** •AC230V, 50Hz **Inclusive of 2 Year of onsite warranty**											
2.	**Voltmeter 0-500V (Analog)** PMMC TYPE Analog meter measures voltage in the range of 0 to 500 volts 4mm stackable plug leads included Accuracy: +/-2% Unbreakable Plastic Range: 0-500V	**2**	**6**	**6**	**0**	**0**	**2**	**3**	**6**	**0**	**25**	
3.	**Voltmeter 0-500V (Analog)** MOVING IRON TYPE **Voltmeter 0-500V (Analog)** MOVING IRON TYPE Analog meter measures voltage in the range of 0 to 500 volts	**2**	**6**	**6**	**0**	**0**	**2**	**3**	**6**	**0**	**25**	

	4mm stackable plug leads included Accuracy: +/-2% Unbreakable Plastic Range: 0-500V											
4.	**Ammeter 0-1-2A (Analog)** MOVING IRON TYPE MOVING IRON TYPE Ammeter 0-5 Amp. Accuracy± 2.0% With lock type terminal packed in Thermocol box DC mounted	2	6	6	0	5	2	3	6	0	30	
5.	**Ammeter 0-2.5-5A (Analog)** PMMC TYPE PMMC TYPE Ammeter 0-5 Amp. Accuracy± 2.0% With lock type terminal packed in Thermocol box DC mounted	2	6	6	0	0	2	3	6	0	25	
6.	**Ammeter 0-5-10A (Analog)** MOVING IRON TYPE MOVING IRON TYPE Ammeter 0-5 Amp. Accuracy± 2.0% With lock type terminal packed in Thermocol box DC mounted	4	6	6	0	0	2	3	6	0	27	
7.	**Wattmeter** LPF Dynamometer type LPF Dynamometer type Current Range 5-10A voltage range 75-300-600V Clock Accuracy Less Than 0.5 s/Day Scale Length 150mm Accuracy +/- 1.5%, ISS 1248/83 Lifetime More Than 10 Years Voltage 220V/230V/240V	4	1	0	0	2	2	2	0	0	11	
8.	**Wattmeter 5-10A, 75-300-600V** UPF Dynamometer type UPF Dynamometer type Current Range 5-10A voltage range 75-300-600V Clock Accuracy Less Than 0.5 s/Day	2	1	0	0	2	2	2	0	0	9	

	Scale Length 150mm Accuracy +/- 1.5%, ISS 1248/83 Lifetime More Than 10 Years Voltage 220V/230V/240V											
9.	**Megger 500V 1000MΩ** Digital Insulation Tester, Single Person Push Button Operation High Accuracy 5 Percent of Indicated Value in Effective Range Scale Length: 80 Millimeters Abs Resin Yellow Case With Acrylic Meter Cover Meets Requirement of Iec1010, Installation Category Ii, 1000v Phase Earth	2	0	0	0	0	2	2	0	0	6	
10.	**Bridge Trainer Kit** **Salient Features** • Aesthetically designed injection molded electronic desk carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure, & has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Set of Users Guide provided with each Unit. **SPECIFICATIONS** **•Built in Power Supply :** DC Supply :5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA (Isolated High Volt DC 15V to 110V, 100Ma, AC Supply :	2	0	0	0	0	2	2	0	0	6	

	12-0-12V AC,150 mA. Short circuit Protected. •**Built in Function Generator –** O/p Waveform : Sine, Triangle & TTL O/Ps Output Frequency : 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) •**Clock Generator :** 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, for High / Low indication. •**Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt : 2V/200V - 1No. (B) DC current : 2mA/200mA - 1No. (C) DC Volts/Current : 20V/200mA - 1No. •**Onboard moving iron meters provided for** (A) AC Current : 1 AMP - 1No. (B) AC Voltage : 15V - 1No. •Onboard speaker : 8 Ohms, 0.5 Watt (1No.) •Onboard POTS : 1K - 1No. 1M - 1No. •Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA.												

	DC/AC Bridge circuits Expt. Panel : Wheatstone's Bridge, Kelvin's Bridge, Maxwell's Bridge, Hay's Bridge, DC Sauty's Bridge, Owen's Bridge, Anderson's Bridge, Shearing Bridge, Wien bridge. Provided with 2 capacitor decades [100pF to 100uF]. 1 resistor decade [10E to 100mohm], 1 tapped wire wound 10 taps (0.01 ohm) 10k, 10T pot, 1000 ohm pot, fixed resistors of 10 & 4.7 ohm, Earphone & its socket. **Inclusive of 2 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**											
11.	**Digital Earth Tester** dual range: 0-10 ohm and 0-1000 ohm with rechargeable batteries with cover bag	2	0	0	1	0	2	3	0	0	8	
12.	**Energy Meter 1-phase** 1-Phase Electric Energy LCD Sub Meter (2 Wire, 240V, 50Hz, 3200 imp/kWh Class-1.0, ISI Mark) - 5-30 Amp. Single Phase Meters 1 phase, 2 wire, class 1, whole current, Tamper proof, Time of Use, Static Electricity meter conforming to IEC-62053-21/23, IEC-62054 and IS 13779	2	6	6	1	0	2	2	3	0	22	
13.	**Trivector Meter** 3PHASE DIGITAL MEASURING KW, KVAR, KVA	2	5	0	1	1	2	1	0	0	12	
14.	**DC MOTOR CUT SECTION for LAB APPLICATION WITH MANUAL** Type DC Series Frequency 50 Hz	2	1	1	0	1	1	1	1	0	8	

	Current rating 3 A Speed 1500 rpm Power Rating 300 W RPM 1500 R.P.M Voltage Rating 180 V											
15.	**Transistor Characteristics NPN-PNP Trainer Kit** **Salient Features** • Aesthetically designed injection molded electronic desk carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure, & has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Set of Users Guide provided with each Unit. **SPECIFICATIONS** **•Built in Power Supply :** DC Supply :5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA (Isolated High Volt DC 15V to 110V, 100Ma, AC Supply : 12-0-12V AC,150 mA. Short circuit Protected. **•Built in Function Generator –** O/p Waveform : Sine, Triangle & TTL O/Ps Output Frequency : 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min),	**2**	**0**	**0**	**0**	**1**	**0**	**2**	**1**	**0**	**6**	

	+ 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) •**Clock Generator** : 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, for High / Low indication. •**Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt : 2V/200V - 1No. (B) DC current : 2mA/200mA - 1No. (C) DC Volts/Current : 20V/200mA - 1No. •**Onboard moving iron meters provided for** (A) AC Current : 1 AMP - 1No. (B) AC Voltage : 15V - 1No. •Onboard speaker : 8 Ohms, 0.5 Watt (1No.) •Onboard POTS : 1K - 1No. 1M - 1No. •Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA. **Semiconductor & Power Semiconductor Devices Experiment Panel :** Characteristics of following devices : Silicon diode, Semiconductor Testing using Multimeter, Germanium diode, zener diode, LED, diac, bipolar transistor (NPN, PNP), Field Effect Transistor (FET), MOSFET, IGBT, UJT, Silicon Controlled Rectifier (SCR), Triac, Optocoupler, Thermistor, V-I Characteristics on CRO of SCR, Triac,												

	Transistor as a Switch & MOSFET as a Switch. Band gap energy calculations. **Inclusive of 2 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**											
16.	**Trainer kit for Turn off circuit OF SCR for laboratory purpose** **Features** •Aesthetically designed injection molded electronic desk. •Main Unit carrying useful experiment resources like line Synchronized firing circuits, Power supplies, lamp load, RLC loads, Battery Charging supply etc. while the central slot will hold replaceable experiment panels. • Each multi experiment panel is secured in an ABS molded plastic sturdy enclosure, & has colorful screw less overlay showing circuit & Connection through Sturdy 4mm Banana Sockets & Patch Chords. • Set of User Guide provided with each unit. **• Power Scope** • Accessory for any Lab CRO for off ground differential measurements upto 1000Vdc to facilitate checking inverter / converter waveform. **Main Unit** **Built in power supply** • DC supply : + 12V, 500mA, • Unregulated Power supply 17V / 750mA, • Regulated 7VDC to 14VDC/3A O/P is provided as 12V Battery charging supply. In absence of battery, same may	2	1	0	0	1	1	1	0	0	6	

	be used as simulated battery source to run experiments on inverters etc. • Isolated DC supply +12V/ 300amA with isolated common. • On board Inverter transformer of Primary & Secondaries: 12-11-0-11-12/3A. • On board o/p to Isolated Drive Circuit **AC supply** • 230V AC line voltage is made available on two banana 4mm sockets as well as 1.5A fuse extender for variac if used. • Aux DC Power Supply : (Useful as field / armature supply for DC motor) • Variable upto 200Vdc/0.5Amp (Phase controlled Thyristor half bridge) • Field ON/OFF control with field failure relay & over current protection circuit. **LSPT Panel consisting of** • Two pulse transformers of 1:1:1 are provided for isolation & supplying firing pulses along with required DC Power supply to experiment panel under test through 15 pin female 'D' connector. • Selector switch of 2 pole 6 way for selecting different types of firing pulses like out of phase inverter firing using LM3525 with dead time, freq. Control in freq variation from 170 Hz to 250Hz, 12.5/25/6..25 Hz Frequency gated with High •Frequency (3KHz) for Cycloconverter, line Synchronized UJT firing for converter & pulse width **R-L-C Load Panel** • Load resistor of 10ohm/ 40W & 100ohm / 10W -												

	1No.each • Centre tapped 3A choke 4mH/ 16mH each -2Nos. • DC choke 0-100-200 mH/750mA- 1No. • Commutation capacitors of 10uF/100V - 4Nos. • AC Paper capacitor of 4uF/440V - 1No. • DC Cap 220uF / 63V- 1No. • Diode BYT 71 (5407)- 1 No. • On board Lamp load of 15W/ 230VAC provided **Accessories:** • 15 pin D connector cable assembly, • 4mm patchcords : 100mm X 10 Nos & 500mm X 20 Nos. **CON / INV Panel** • SCR Converters - Provided with sturdy 800V/12A SCRs (4nos) with uncommitted snubbers, 6A diodes (2nos) commutation switch, 47μF/450V cap, Ramp Cosine firing circuit. However actual working currents are limited to 3A (max) for safety. • Half Wave & Full Wave Fully Controlled converter • AC Voltage Controller using Lamp Universal motor foot mounted. • SCR Controlled Converter 1 phase with R-L Load • Effect of Free Wheeling Diode on SCR converter performance with Inductive load. • Study of SCR converter (Open Loop) output with Inductance Input & Capacitance Input filters • Effect of Source Impedance on performance of SCR converters. • Study of closed loop SCR converters with Resistive Load. • Study of closed loop SCR converters with Motor Load Select motor types from addons below.												

	• Study of full wave -half controlled SCR bridge. • Resonant DC- DC converter. • Advanced firing Schemes • Study of H.F. gate type SCR triggering. • Study of relation between control voltage & SCR converter output DC voltage - using linear resistor controlled synchronized ramp firing (IC815 equivalent). • Study of Linear relation between control voltage & SCR converter output- using cosine firing scheme. • SCR forced Commutation Techniques • Study of forced commutation techniques for SCR, Class A,B,C,D,E,F • SCR based Inverters • SCR based Parallel Inverter. • SCR based series Inverter . • SCR based Bridge Inverter. • SCR based Mcmurray Bedford half bridge inverter. • Cycloconverter • SCR Based cycloconverter • SCR based Chopper • SCR based Jones chopper Resistive load, • SCR based buck (step dn), boost (set up), buck boost chopper **Microcontroller based PE-KIT** To convert above PE model into microcontroller based using microcontroller with application board uC-LSPT in place of LSPT card using keyboard to select mode/set freq. or duty cycle as per expt, 16x2 LCD to display mode & corresponding expt. status, Pulse transformer isolations etc.												

	List of experiments: Thyristor based - Converters, Inverters, Cycloconverters, Choppers etc. MOSFET/IGBT based - Choppers, Inverters etc. (All .Hex & C listing files are provided on a CD, you need to download them into kit by ISP method to perform experiments). **Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection moulded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**											
17.	**SMPS Trainer Kit** **Salient Features** • Aesthetically designed injection molded electronic desk carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure, & has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Set of Users Guide provided with each Unit. **SPECIFICATIONS** **•Built in Power Supply :** DC Supply :5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA	2	2	0	1	2	0	2	0	0	9	

	(Isolated High Volt DC 15V to 110V, 100Ma, AC Supply : 12-0-12V AC,150 mA. Short circuit Protected. **•Built in Function Generator –** O/p Waveform : Sine, Triangle & TTL O/Ps Output Frequency : 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) **•Clock Generator :** 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, for High / Low indication. **•Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt : 2V/200V - 1No. (B) DC current : 2mA/200mA - 1No. (C) DC Volts/Current : 20V/200mA - 1No. **•Onboard moving iron meters provided for** (A) AC Current : 1 AMP - 1No. (B) AC Voltage : 15V - 1No. •Onboard speaker : 8 Ohms, 0.5 Watt (1No.) •Onboard POTS : 1K - 1No. 1M - 1No. •Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA												

	Advance DC to DC Converter Panel : Open loop & Closed loop scheme for Step Up (Boost), Step Down (Buck), Polarity Inverter (Buckboost), Forward, Fly back, Push Pull, Negative Voltage Converter, Cascaded Negative Voltage Converter, Cuk Converterm, Various SMPS topologies. **Switch Mode Power Supply Expt. Panel :** SMPS (TV), To study Crow bar protection circuit. **Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection moulded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**											
18.	**UPS Trainer Kit** Aluminum Profile Sturdy Modular Flat demo panel system (table top), carrying various high voltage components housed in plastic enclosures (panel) to minimize shock possibility **The Trainer should consists of following Electrical Specification :** •Input range is 170-270V A.C./50Hz. •Output (Input present) 195-250V sine. •Output (Input unhealthy / absent) •230 V + 5% Quasi-sine. •Capacity 200W lamp load on AVR. •Battery 12V / 7Ah, 'Panasonic'	2	2	0	0	2	0	2	0	0	8	

	(Maintence free lead acid) •Bkup of 5 mins on 200W lamp load or 20 min. •17 test points are provided. **The Trainer should consists of following Panels :** • Input / Output Module •Battery / Transformer Module •AVR / Charger Module •Inverter Module **The Trainer should cover following Experiments:** •Study of AVR charger •Study of change over logic •Study & working of typical offline UPS **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**											
19.	**Three Phase Induction Motor cut section for LAB APPLICATION** Motor Poles-4 Output Power 300W Type-General Performance Three Phase Squirrel Cage TEFC Cast Iron Induction Motor Synchronous speed (rpm)-1500 Rated Voltage (Volts) 415 Volts (+/- 10%) Winding-Copper, Body Material/ Housing/ Casing-Cast Iron	**2**	**2**	**0**	**0**	**1**	**1**	**1**	**1**	**0**	**8**	

	Insulation Class-F ,Operating Frequency-50 Hertz (+/- 5%),Efficiency Class-IE3											
20.	**Three Phase 6 cage Induction Motor trainer kit ,** **SALIENT FEATURES** • Facilitates easy & safe wiring by students due to use of 4mm sturdy shrouded banana patch cords & shrouded socket arrangements. • All machines are mounted on finely painted sturdy base frame. • With due emphasis on student safety machines operate upto 300W power levels & upto 1500 RPM, without compromising didactic use Able to draw all graphs. • Brake pulley arrangement for variable loading of motor. • Set of Students Workbook & Instructors Guide. **A] Motor Specifications** **3 Phase Squirrel cage Induction motor : -** Voltage: 415VAC, 50Hz, Capacity: 300W/4 pole/ 1500RPM/12 terminals, Rotor construction: Diecast Squirrel cage rotor, Stator construction: 6X2 terminals brought out to run machine at two speeds using pole changing method (Dahellander winding) Frame/mounting: 100 frame, chassis mounted, 19mm shaft dia. Loading arrangement: Friction brake pulley (60.5mm dia) for loading arrangement with 20Kg spring balance for torque measurement. Speed Measurement: Using hand held tachometer. **B]Control Panel Specifications** Aluminum profile (4X1) sturdy Modular flat panel (table top) system, carrying various high voltage components housed in plastic enclosures (panel) to minimise shock	2	1	1	0	0	0	1	1	0	6	

	possibility. **Input 3 phase DOL Starter panel** • 4 pole MCB of 415 V/4A. • DOL 9A Contactor with 230V / 50 Hz / 11VA Coil . • Bimetallic thermal O/L relay with range 1.4A - 2.3A . • R-Y-B Input Indicators. **Integrated AC 3 phase multifunction measurement panel Bidirectional Multifunction** • 3 Phase ¾ wire, 415V, CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V,I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 **FWD-OFF-REV Switch panel** • FWD/REV, 3 pole 3 way switch with centre OFF, 6A/440V. • Accessories : Hand held digital Tachometer, 3 Ph. / 3A variac **List of Experiments** 1)Speed torque characteristics of 3 phase squirrel cage induction motor. 2)Efficiency, % slip & input power factor measurement of 3 phase squirrel cage induction motor. 3)Speed control of Squirrel Cage Induction motor by pole changing method. 4)'No Load Test' & 'Blocked Rotor Test' on 3 Ph. squirrel cage induction motor. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the**												

	students.											
21.	**UNIVERSAL MOTOR** **SALIENT FEATURES** • Facilitates easy and safe wiring by students due to use of 4mm sturdy shrouded banana patch cords and shrouded socket arrangements. • All machines are mounted on finely painted sturdy base frame. • With due emphasis on student safety machines operate upto 300W power levels and upto 1500 RPM, without compromising didactic use Able to draw all graphs. • Brake pulley arrangement for variable loading of motor. • Set of Students Workbook & Instructors Guide. **Motor Specifications :** **Universal motor:** Voltage : 230VAC, 50Hz/150VDC, Capacity: 300W/4 pole/ 1600 /1500 RPM/4 terminals, Rotor construction: Standard commutator brush arrangement brought out on 2 terminals. Stator construction: Stator brought out on 2 terminals to facilitate Six terminal are brought out to start the machine using star-delta starter, Frame/mounting: 100 frame, chassis mounted, 19mm shaft dia. Loading arrangement: Friction brake pulley (60.5mm dia) for loading arrangement with 20Kg spring balance for torque measurement. Speed Measurement: Using hand held tachometer. **Control Panel Specifications** Aluminum profile (4X2) sturdy Modular flat panel (table top) system, carrying various high voltage components	2	1	1	1	1	1	1	1	0	9	

	housed in plastic enclosures (panel) to minimise shock possibility. **1 phase Motor, Alternator & Sync. Motor Panel** 1) 1 Phase MCBs of 4A/1.6A 1 each. 2) Lamp load. **Integrated AC 1 phase multifunction measurement panel** 1) Bidirectional Multifunction Meter 2) 3 Phase 3/4 wire, 415V, CT Input 5A 3) LCD/LED display, Aux supply 230V, 45-65 Hz, 5W 4) V.I., Hz, Pf, KVA, KW,KWH 5) Modbus RTU RS 485 **SCR Actuator (variable DC) cum sensor signal conditioning** panel 1)Full bridge SCR based 0V-195V / 5 Amp cosine firing with linear charateristics. 2) Supports signal conditioning circuit for speed, torque in kg wt to output 0-2.5Vdc (FS). **Instrumentation Power supply cum Multichannel DPM panel** (1) +/-12 V, 500 mA (2) +5V, 300mA (3) Unregulated 17V dc/750 mA (4) line synchronizing signal. (5) 13V / 3 Amp. (6) Multi channel DPM for digital display of torque, speed etc **DC voltmeter and DC ammeter panel** a) DC voltmeter (0-300V) b) DC Ammeter (0-5A) with polarity protection diode c) 4A Circuit Breaker. **Variable AC/DC power Supply Panel** 1) AC output 0 to 270V / 3 Amp. 2) DC output 0 to 230V / 3 Amp. **List of Experiments :**												

	1) Study of Speed-Torque Characteristics of Universal motor on AC operation. 2) Study of Efficiency and Input power factor of Universal motor for various loading conditions (AC operation). 3) Study of Speed-Torque Characteristics of Universal motor on DC operation. 4) Study of Efficiency of Universal motor for various loading conditions (DC operation) **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**											
22.	**STEPPER MOTOR** **SALIENT FEATURES** • Aesthetically designed injection molded electronic desk (Main unit) carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure, & has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Set of Users Guide provided with each Unit. **SPECIFICATIONS OF MAIN UNIT** **•Built in Power Supply :**	**2**	**5**	**0**	**0**	**1**	**0**	**1**	**1**	**0**	**10**	

	DC Supply :5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA (Isolated High Volt DC 15V to 110V, 100Ma, AC Supply : 12-0-12V AC,150 mA. Short circuit Protected. **•Built in Function Generator –** O/p Waveform : Sine, Triangle & TTL O/Ps Output Frequency : 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) **•Clock Generator :** 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, for High / Low indication. **•Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt : 2V/200V - 1No. (B) DC current : 2mA/200mA - 1No. (C) DC Volts/Current : 20V/200mA - 1No. **•Onboard moving iron meters provided for** (A) AC Current : 1 AMP - 1No. (B) AC Voltage : 15V - 1No. •Onboard speaker : 8 Ohms, 0.5 Watt (1No.) •Onboard POTS : 1K - 1No. 1M - 1No.												

	•Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA **Stepper Motor Demonstrator Expt. Panel :** Control of direction, Step rate, Auto/Manual operation of stepper either built in 7.5 degree step or optinally external 3kg-cm motor [1.8 degree] in half/full/wave stepping modes/current chopper mode. **Inclusive of 2 year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students).**											
23.	**Three Phase squirrel cage Induction Motor trainer kit FOR SPEED CONTROL USING AUTO TRANSFORMER AND VVVF METHOD** **SALIENT FEATURES** • Easy & safe wiring by students due to 4mm sturdy shrouded banana patch cords & shrouded socket arrangement for high voltage circuits. • Facilitates easy learning about operative characteristics of ubiquitous squirrel cage induction motor. • Each panel has ABS molded plastic sturdy enclosure, & colorful screw less overlays showing circuit diagram & its connection tag numbers for easy understanding & connections. • Set of Instructor Guide & Student Workbook. **Technical Specifications** Aluminum profile sturdy Modular flat demo panel system	2	2	1	0	0	0	1	1	0	7	

	(table top), carrying various high voltage components housed in plastic enclosures (panel) to minimize shock possibility. **1) 1 ph. Motor, Alternator & Sync. Motor Panel** 1 ph. MCBs of 4A/1.6A - 2nos, bulb load. **2) Integrated AC (1 phase) measurement panel** • Bidirectional Multifunction Meter • 3 Phase 3/4 wire, 415V, CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V.I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 **3) AC voltmeter panel** • Voltage range : 300V • 1 pole 4 way switch to select line voltage for three phase **4) Dual range AC ammeter panel** • Current range:2A/6A selectable . • 1 pole 7 way switch to select phase current for three phase **5) IGBT Controlled AC Drive panel** 1) Input voltage: 230VAC. 50Hz 2) Output voltage: 3 phase 200 to 230VAC 3) Range (Frequency Control) : 0.1 Hz to 100 (400)Hz 4) Control Mode :Sine Wave PWM 5) Capacity : ½ HP 6) With Reverse & Forward Direction 7) Mech: single width for ½ HP **6) Motor specifications :** 3 phase squirrel cage induction motor, ½ HP 4 pole, 1500RPM, 6 terminal (delta 220Vac/star 440Vac) motor with Hand held Tachometer for speed measurement **7) List of Experiments :** • Study of Speed-Torque Characteristics of 3 Ph. Squirrel												

	Cage Induction Motor & to verify constant v/f ratio • [VFD I/P = 230VAC L-N, O/P=220VAC L-L] • Study of Speed-Torque Characteristics of 3 Ph. Squirrel Cage Induction Motor & to verify constant v/f • Study of efficiency of AC motor. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students.**											
24.	**Lux Meter** DISPLAY 3½ digit,18mm(0.7") LCD (Liquid Crystal Display), RANGE 0-50,000 Lux. 3 ranges, ACCURACY ± (, 5% rdg + 2 dgts) SAMPLING TIME 0.4 second, OPERATING TEMPERATURE 0° to 50°C. (32° -122 °F)	2	6	6	0	1	5	1	6	0	27	
25.	**House & Commercial Wiring Installation Trainer** **Salient Features:** • Facilitates study of transformer operation, determine its equivalent circuit, use of tertiary winding to suppress harmonics etc. • Facilitates easy & safe wiring by students due to 4mm sturdy shrouded banana patch cords & shrouded socket arrangement for high voltage circuits. • Each of following standalone Electrical trainers may need a set of associated panels which are mounted in a light weight sturdy aluminium flat demo panel system. • Each panel has ABS molded plastic sturdy enclosure, &	2	0	1	0	1	1	1	1	0	7	

	colorful screw less overlays showing circuit diagram & its connection tag numbers for easy understanding & connections. • Set of Instructor Guide & Student Workbook. **Technical Specifications** Aluminum profile Sturdy Modular Flat Panel system, carrying various high voltage components housed in plastic enclosures (panel) to minimize shock possibility. **Input 3 phase DOL Starter panel** • 4 pole MCB of 415 V/4A . • DOL 9A Contactor with 230V / 50 Hz / 11VA COIL . • Bimetallic thermal O/L relay with range 1.4A - 2.3A for 300VA or 3A -5A for 1KVA/3kVA. **3 Phase Bidirectional power cum Energy meter panel x 3 nos.** • Bidirectional Multifunction Meter • 3 Phase 3/4 wire, 415V CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V.I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 (optional) **FWD-OFF-REV switch panel** • FWD/REV, 3 pole 3 way switch with centre OFF, 6A/440V. **1 phase AC Input supply panel** • 1 phase MCBs of 4A/1.6A - 2nos. • Bulb Load.												

	AC voltmeter panel • Voltage range : 500V. • 1 pole 4 way switch to select line voltage for three phase **Dual range AC ammeter panel** • Current range:2A/6A selectable . • 1 pole 7 way switch to select phase current for three phase **Milliohm (V-I method) / Rect/ CAP Load Panel** • Transformer : 230V/14V/3A. • DC Voltmeter : (0 –10Vdc). • DC Ammeter : (0 –2A). • Diode bridge rectifier with Rectifying capacitor **Resistive Load** • **AC Resistors** 10K/5K/3.5K/2.5K/2K/1.5K/OFF (6 taps+1 OFF) 200W x 3 phase • **DC Resistors** 750E/600E/300E/212E/162E/ 125E/112E/100E/400W /8 taps + OFF + separate 60E tap for DC series Gen. **Lamp Load** • 230V/100W X3 bulbs with individual ON/OFF using 6A toggle. **Parameters :** • **VA rating :** 300VA • **X mer type: 1 Phase/ 3 Phase** • **Construction :** Double wound iron core EL STEP DOWN												

	xmer/ Iron core strip lamination type step down Delta primary / Star secondary design. • **Primary :** 3 Nos. Isolated primaries 0-415/0.24A at 50Hz brought out on 3 x 4 sockets • **Secondary** : 3 Nos. Isolated windings groups main 110V/0.5A, zigzag 110V/0.5A, Tertiary 220V/0.25A brought out on 4 x 3 x 3 sockets. • **Accessories:** 3 Phase / 3 Amp. Variac (table top) **List of experiments :** 1. Study of Manufacturing Quality Tests. 2. Study of Insulation resistance test. 3. Study of Turns ratio test 4. Study of Polarity test. 5. Study of Performance tests. 6. Study of Open circuit test 7. Scott connection : Using 2 nos. of 1 phase Transformer 8. Study of Load regulation test. 9. Study of Back to back test (sumpner test) 10. Study of Winding temperature rise test. 11. Measurement of winding resistance by DC V–I method. 12. Study of effect of type of load on transformer output waveform 13. Study of Parallel operation of single-phase transformers 14. Study of Scott connection for 3phase to 2 phase conversion 15. Three phase transformers - basic configurations –												

	their effect on capacity utilization regulation. 16. Study of Phasor Groups in 3 Phase Transformer connections 17. Study of Phasor Group1 connections in 3 phase Transformer. 18. Study of Phasor Group2 connections in 3 phase Transformer. 19. Study of Phasor Group3 connections in 3 phase Transformer. 20. Study of Phasor Group4 connections in 3 phase Transformer. 21. Study of using Tertiary winding on 3 phase transformers for suppressing harmonics. 22. Study of Load regulation, efficiency & Temp. rise test on 3 phase Transformers 23. Study of Manufacturing Quality Tests on 3 phase transformers 24. Study of Short circuit test 25. Determination of zero sequence reactance of 3 phase transformer. 26. Determination of equivalent circuit of 3 phase transformer 27. Self & mutual inductance measurement of 1 phase transformer 28. Determination of equivalent circuit of 3 phase transformer.												
	Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the												

	students.											
26.	**Speed Control of DC Shunt Motor Trainer** **The Trainer should have following features :** • Following trainer may need a few set of associated panels (4 nos. typically) which are mounted in a light weight sturdy Aluminum flat demo panel system. • Facilitates easy & safe wiring by students due to 4mm sturdy shrouded banana patch cords & shrouded socket arrangement for high voltage circuits. • Each panel has ABS molded plastic sturdy enclosure, & colorful screwless overlays showing circuit diagram & its connection tag numbers for easy understanding & connections. • Set of Instructor Guide & Student Workbook **Technical specifications:** It should consists of : **1] Instrumentation Power supply cum Multi- channel DPM panel** (a) +/-12 V, 500 mA (b) +5V, 300mA (c) Unregulated 17V dc/750 mA (d) line synchronizing signal. (e) Multi channel DPM for digital display of speed, etc. **2] SCR Actuator (variable DC) cum sensor signal conditioning panel** 1. Full bridge SCR based 0V-195V / 12 Amp cosines firing with linear characteristics. 2. Supports signal conditioning circuit for speed to give output 0-2.5Vdc (FS).	**2**	**1**	**1**	**0**	**0**	**1**	**1**	**1**	**0**	**7**	

	3. 2 Nos. of these supplies required for DC Armature & DC motor field. **3] DC voltmeter & DC ammeter panel** a) DC voltmeter (0-300V) b) DC Ammeter (0-5A) with polarity protection diode c) Field failure relay to control Armature supply. **4] DC Integrated Motor Specifications** 180V/300W/1500RPM with series shunt & compound windings, Chasis mounted table top with spring balance loading arrangement [10kg] & Electronic Tacho: 1V/1000RPM. **List of Experiments** 1. Open loop torque speed characteristics. 2. Closed loop speed control using Armature voltage / speed feed back using P/PI mode. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
27.	**Speed Control of DC Series Motor Trainer** **The Trainer should have following features :** • Following trainer may need a few set of associated panels (4 nos. typically) which are mounted in a light weight sturdy Aluminum flat demo panel system. • Facilitates easy & safe wiring by students due to 4mm sturdy shrouded banana patch cords & shrouded socket	2	1	0	0	0	0	1	1	0	5	

	arrangement for high voltage circuits. • Each panel has ABS molded plastic sturdy enclosure, & colorful screwless overlays showing circuit diagram & its connection tag numbers for easy understanding & connections. • Set of Instructor Guide & Student Workbook **Technical specifications:** It should consists of : **1] Instrumentation Power supply cum Multi- channel DPM panel** (a) +/-12 V, 500 mA (b) +5V, 300mA (c) Unregulated 17V dc/750 mA (d) Line synchronizing signal. (e) Multi channel DPM for digital display of speed, etc. **2] SCR Actuator (variable DC) cum sensor signal conditioning panel** 1. Full bridge SCR based 0V-195V / 12 Amp cosine firing with linear characteristics. 2. Supports signal conditioning circuit for speed to give output 0-2.5Vdc (FS). 3. 2 Nos. of these supplies required for DC Armature & DC motor field. **3] DC voltmeter & DC ammeter panel** a) DC voltmeter (0-300V) b) DC Ammeter (0-5A) with polarity protection diode c) Field failure relay to control Armature supply. **4] DC Integrated Motor Specifications** 180V/300W/1500RPM with series shunt & compound windings, Chasis mounted table top with spring balance loading arrangement [10kg] & Electronic Tacho: 1V/1000RPM.												

	List of Experiments 1. Open loop torque speed characteristics. 2. Closed loop speed control using Armature voltage / speed feedback using P/PI mode. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
28.	**Functioning of CT, PT and Isolation Transformer Complete Trainer** **SALIENT FEATURES** • Facilitates study of CT, PT tests. 3 ph., 1 ph., power measurement, calibration of energy meter, pf measurement etc. • Facilitates easy & safe wiring by students due to 4mm sturdy shrouded banana patch cords & shrouded socket arrangement for high voltage circuits. • Each panel has ABS molded plastic sturdy enclosure, & colorful screwless overlays showing circuit diagram & its connection tag numbers for easy understanding & connections. • Set of Instructor Guide & Student Workbook. • Digital multifunction meters for measurement of all parameters (V, I, W, PF, VA, VAR, Energy). • Short circuit protection due to over loading or wrong connections.	2	1	1	0	1	2	1	0	0	8	

	• Measurement CTs & protection CT provided to plot magnetization curve of Cts. **Technical Specifications** A] Aluminum rack 4 x 3 profile sturdy Modular flat panel (table top) system, carrying various high voltage components housed in plastic enclosures (panel) to minimize shock possibility. **Input 3 phase DOL Starter panel** • 4 pole MCB of 415 V/2A. • DOL 9A Contactor with 230V / 50 Hz / 11VA COIL. • Bimetallic thermal O/L relay with range 1.4A - 2.3A . **Integrated AC (1phase) measurement panel** • Bidirectional Multifunction Meter • 3 Phase 3/4 wire, 415V, CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V.I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 **Integrated AC (3/1 phase) measurement panel** • Digital meter (96X96mm) for measurement of 3Ø & 1Ø parameters. • Voltage line to line & line to neutral. • Current for all 3Ø up to 5A. • Power factor, frequency, watts, VAR, VA & energy in Kwhr. **Potential Transformer [PT] Panel** • Consists of 2 nos. of PTs (230V:24V secondary), 200VA with both primary &secondary terminated at shrouded													

	4mm sockets. • Null detection & balancing components- 2 capacitors (100pF, 0.001uF) & 47K, 33K resistors & 470K pot. **Current Transformer [CT] Panel** • Consists of 2 nos. of EI core CTs (5A:1A secondary) & 1 no. of ferrite CT (40A: 0.4A Sec.) with both primary & secondary terminated at shrouded 4mm sockets. • Null detection & balancing components- 3 capacitors (10uF, 1uF, 0.1uF) & 100E / 0.25W, 0.1E, 0.01E 5W resistors, 500E pot. **Single Phase Input MCB Panel** • 1 Ph. MCBs of 4A/1.6A 2nos. • 1 no. of Lamp Holder with input terminals. **Lamp Load** 230V /15/40/60/100W X 3 bulbs with individual ON/OFF using 6A toggle switch. **Resistor Load panel** (1) AC Resistors: 10K / 5K / 3.5K / 2.5K / 2K / 1.5K / OFF 200W x 3 phases / 6 taps. (2) DC Resistors : 750E / 600E / 300E / 212E / 162E / 125E/ 112E / 100E / 400W /8 taps + OFF + separate 60E tap for DC series Gen. **LC Load panel** (1) Inductive load: 0.15H/0.3H/0.45H/0.6H/0.75H/1.5H/ 3H /400mA X 3Nos. (2) Capacitive load : 1.25u /2.5u/5u/415VX 3Nos													

Variable AC Voltage & current injector Panel

- Variable AC voltage O/P : 0-270V/0.75A
- Variable AC current O/P : 0-12 Amp

Phase angle meter panel

- Measure phase angle between two voltages (230/ 440 Vac, 50Hz)
- Internally 2 Pts for isolation
- 1 phase 300VA transformer with primary 0-230Vac & secondary 0 - 115 - 230Vac as sample to measure iron loss in transformer using Lloyd fisher square method

List of Experiment :

1. Current transformer (CT) testing
2. Potential transformer (PT) testing
3. Calibration of single phase energy meter
4. Measurement of 3ø power by 2 wattmeter method
5. Measurement of 3ø power by 1 & 3 wattmeter method
6. Measurement of power in a 1ø AC circuit using 3 ammeter method
7. Measurement of power in a 1ø AC circuit using 3 voltmeter method
8. Find out filament resistance at cold & hot condition.
9. Power factor improvement technique using shunt capacitor
10. Study effect of grounding of the neutral point in a 3 ph. system.
    a) Solidly grounded neutral
    b) Resistance grounded neutral
    c) Floating neutral (ungrounded)
11. Plot the magnetization curve of measurement CT & Protection CT & determine knee point voltage.

	12. Self & mutual inductance measurement of PT **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
29.	**Voltmeter and ammeter method for measurement of medium resistance.** **SALIENT FEATURES** • Aesthetically designed injection molded electronic desk (Main unit) carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure, & has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Set of Users Guide provided with each Unit. **SPECIFICATIONS OF MAIN UNIT** **•Built in Power Supply :** DC Supply: 5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA (Isolated High Volt DC 15V to 110V, 100Ma, AC Supply : 12-0-12V AC,150 mA. Short circuit Protected. **•Built in Function Generator –** O/p Waveform : Sine, Triangle & TTL O/Ps	**2**	**0**	**0**	**1**	**1**	**2**	**2**	**1**	**0**	**9**	

	Output Frequency: 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) •**Clock Generator:** 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, for High / Low indication. •**Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt: 2V/200V - 1No. (B) DC current: 2mA/200mA - 1No. (C) DC Volts/Current: 20V/200mA - 1No. •**Onboard moving iron meters provided for** (A) AC Current: 1 AMP - 1No. (B) AC Voltage: 15V - 1No. •Onboard speaker: 8 Ohms, 0.5 Watt (1No.) •Onboard POTS: 1K - 1No. 1M - 1No. •Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA. **AVO Meter, Lamp, Relays, Cells Expt. Panel:** 1.5 x 4 No. cells for series parallel expts., moving coil meter (100 uA) to construct voltmeter, ammeter AC / DC & ohmmeter,												

	bulbs in series parallel, Relay characteristics, staircase lamp logic, Static & Dynamic characteristics. **Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students STC).**											
30.	**Clamp Meter** 300A AC/DC : 3 ¾ Digits digital Clamp meter, measures important electrical parameters like AC Current, AC Voltage, DC Voltage. It also features Capacitance, Ohm & Continuity, frequency, Duty cycle and temperature measurement. DC Voltage: 1000 V, Current: 300A, At 0° .... + 40 °C, Maximum count 3100 counts, Over range indication "OL" is displayed. Battery Voltage 9 V DC,	0	6	6	0	0	0	2	6	0	20	
31.	**DC, AC & Wave Shaping Circuit Trainer** **SALIENT FEATURES** • Aesthetically designed injection molded electronic desk (Main unit) carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure, & has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Set of Users Guide provided with each Unit.	2	0	1	0	1	0	0	0	0	4	

	SPECIFICATIONS OF MAIN UNIT **•Built in Power Supply :** DC Supply: 5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA (Isolated High Volt DC 15V to 110V, 100Ma, AC Supply: 12-0-12V AC, 150 mA. Short circuit Protected. **•Built in Function Generator –** O/p Waveform : Sine, Triangle & TTL O/Ps Output Frequency: 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) **•Clock Generator:** 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, for High / Low indication. **•Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt: 2V/200V - 1No. (B) DC current: 2mA/200mA - 1No. (C) DC Volts/Current: 20V/200mA - 1No. **•Onboard moving iron meters provided for** (A) AC Current: 1 AMP - 1No. (B) AC Voltage: 15V - 1No.												

	•Onboard speaker: 8 Ohms, 0.5 Watt (1No.) •Onboard POTS: 1K - 1No. 1M - 1No. •Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA. **DC, AC & Wave Shaping Circuit Experiment Panel :** DC : Resistance, current & voltage measurements, Loading of Potentiometer, Ohm's law, Power DC circuits, Series, parallel & mixed circuits, Kirchoff's law, Superposition theorem, Thevenin's & Norton's theorems, Reciprocity, Compensation, Tellegen, Millman theorems & Maximum Power transfer theorem, Voltage distribution of capacitors in series & parallel, total capacitance of capacitors in series & parallel, charging & discharging of capacitor through resistance & time constant, Wheatstone's Bridge, 2 Port Network Y, Z,h, ABCD Parameters & Star Delta Network, T & Pi attenuators. AC : AC Voltage & Current Measurements - R-L series, R-C series, R-L-C series circuit (Series Resonance). R - L parallel, R-C parallel, R-L-C parallel(Parallel Resonance), Active, Reactive power & power factor(Vector Diagram), average & RMS Value measurement. Wave Shaping: Differentiator, Integrator, Clipping, Clamping, Passive filters LC / RC, LPF/ HPF **Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students STC).**												

32.	**Oil testing kit** **Technical Specification :** • Range : 0 — 60 KV Oil Test Kit • Power Supply : 220V AC, 5 0Hz, Single Phase • Voltage Range : 0- 60 KV AC • Indication : Analog / Digital Voltmeter • Transformer: 30 KV, 2 No. Epoxy molded transformer • Bushing : Epoxy molded bushings • Rate of rise of Voltage (for Motorized): 1.2—2KV/Sec. • Resolution: 2KVA **Safety Features**: (i) Zero Start Facility (ii) Over Voltage Protection (iii) Door Lock Safety	2	1	0	0	0	1	0	0	0	4	
33.	**Transformer Trainer 300VA** **Salient Features:** • Facilitates study of transformer operation, determine its equivalent circuit, use of tertiary winding to suppress harmonics etc. • Facilitates easy & safe wiring by students due to 4mm sturdy shrouded banana patch cords & shrouded socket arrangement for high voltage circuits. • Each of following standalone Electrical trainers may need a set of associated panels which are mounted in a light weight sturdy aluminium flat demo panel system. • Each panel has ABS molded plastic sturdy enclosure, & colorful screw less overlays showing circuit diagram & its connection tag numbers for easy understanding & connections.	2	0	1	0	1	1	1	0	1	7	

	• Set of Instructor Guide & Student Workbook. **Technical Specifications** Aluminum profile Sturdy Modular Flat Panel system, carrying various high voltage components housed in plastic enclosures (panel) to minimize shock possibility. **Input 3 phase DOL Starter panel** • 4 pole MCB of 415 V/4A . • DOL 9A Contactor with 230V / 50 Hz / 11VA COIL . • Bimetallic thermal O/L relay with range 1.4A - 2.3A for 300VA or 3A -5A for 1KVA/3kVA. **3 Phase Bidirectional power cum Energy meter panel x 3 nos.** • Bidirectional Multifunction Meter • 3 Phase 3/4 wire, 415V CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V.I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 (optional) **FWD-OFF-REV switch panel** • FWD/REV, 3 pole 3 way switch with centre OFF, 6A/440V. **1 phase AC Input supply panel** • 1 phase MCBs of 4A/1.6A - 2nos. • Bulb Load. **AC voltmeter panel** • Voltage range: 500V. • 1 pole 4 way switch to select line voltage for three phase												

Dual range AC ammeter panel
- Current range: 2A/6A selectable.
- 1 pole 7 way switch to select phase current for three phase

Milliohm (V-I method) / Rect/ CAP Load Panel
- Transformer: 230V/14V/3A.
- DC Voltmeter: (0 –10Vdc).
- DC Ammeter: (0 –2A).
- Diode bridge rectifier with Rectifying capacitor

Resistive Load
- **AC Resistors**

10K/5K/3.5K/2.5K/2K/1.5K/OFF (6 taps+1 OFF) 200W x 3 phase

- **DC Resistors**

750E/600E/300E/212E/162E/ 125E/112E/100E/400W /8 taps + OFF + separate 60E tap for DC series Gen.

Lamp Load
- 230V/100W X3 bulbs with individual ON/OFF using 6A toggle.

Parameters :
- **VA rating :** 300VA
- **X mer type: 1 Phase/ 3 Phase**
- **Construction:** Double wound iron core EL STEP DOWN xmer/ Iron core strip lamination type step down Delta primary / Star secondary design.

	• **Primary:** 3 Nos. Isolated primaries 0-415/0.24A at 50Hz brought out on 3 x 4 sockets • **Secondary**: 3 Nos. Isolated windings groups main 110V/0.5A, zigzag 110V/0.5A, Tertiary 220V/0.25A brought out on 4 x 3 x 3 sockets. • **Accessories:** 3 Phase / 3 Amp. Variac (table top) **List of experiments :** 1. Study of Manufacturing Quality Tests. 2. Study of Insulation resistance test. 3. Study of Turns ratio test 4. Study of Polarity test. 5. Study of Performance tests. 6. Study of Open circuit test 7. Scott connection : Using 2 nos. of 1 phase Transformer 8. Study of Load regulation test. 9. Study of Back to back test (sumpner test) 10. Study of Winding temperature rise test. 11. Measurement of winding resistance by DC V–I method. 12. Study of effect of type of load on transformer output waveform 13. Study of Parallel operation of single-phase transformers 14. Study of Scott connection for 3phase to 2 phase conversion 15. Three phase transformers - basic configurations – their effect on capacity utilization regulation. 16. Study of Phasor Groups in 3 Phase Transformer connections 17. Study of Phasor Group1 connections in 3 phase												

	Transformer. 18. Study of Phasor Group2 connections in 3 phase Transformer. 19. Study of Phasor Group3 connections in 3 phase Transformer. 20. Study of Phasor Group4 connections in 3 phase Transformer. 21. Study of using Tertiary winding on 3 phase transformers for suppressing harmonics. 22. Study of Load regulation, efficiency & Temp. rise test on 3 phase Transformers 23. Study of Manufacturing Quality Tests on 3 phase transformers 24. Study of Short circuit test 25. Determination of zero sequence reactance of 3 phase transformer. 26. Determination of equivalent circuit of 3 phase transformer 27. Self & mutual inductance measurement of 1 phase transformer 28. Determination of equivalent circuit of 3 phase transformer. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
34.	**DC motor coupled to DC motor trainer**	**1**	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**1**	**5**	

	Electrical Machines Trainer set should consist of the following features : **Features :** • Should have 4mm sturdy shrouded banana patch cords & shrouded arrangements. • All machines should be mounted on finely painted sturdy base frame with easy machine Interchange ability. • Should be able to draw all graphs • Machines should operate upto 300W power levels & upto 1500 RPM. • Must use Trunnion mounted DC machine as Dynamometer for loading other machines with facility to measure shaft power using electronic torque / speed measurement • One Dynamometer type DC m/c per Aluminum Rack with multiple panels **A) Technical Specifications of interfacing panel rack - 1 No.** Powder coated Sturdy aluminums Flat panel system made up of Alluminium extruded profiles carrying various high voltage components housed in plastic enclosures to minimize shock possibility. Should be able to hold following control panels with colorful overlay. • **Trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there & shrouded 4 mm banana patch cords & shrouded sockets arrangements for the safety of the students** **B) Each control panel rack consists of : -** **Input 3 phase DOL Starter panel** [10 Shrouded Banana]												

	1 No. •4 pole MCB of 415 V/4A. •DOL 9A Contactor with 230V / 50 Hz / 11VA COIL. •Bimetallic thermal O/L relay with range 1.4A - 2.3A. **Integrated AC (1 phase) measurement panel 1 No. .** •Bidirectional Multifunction Meter •3 Phase 3/4 wire, 415V, CT Input 5A •LCD/LED display, Aux supply 230V, 45-65 Hz, 5W •V.I., Hz, Pf, KVA, KW,KWH Modbus RTU RS 485 **3 Ph. Bidirectional power cum Energy meter panel --1 No.** • Bidirectional Multifunction • 3 Phase ¾ wire, 415V, CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V,I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 **FWD/REV, Star-Delta starter panel --1 No.** • FWD/REV, 3 pole 3 way switch with centre OFF, 6A/440V. • Star/Delta switch 3 pole, 3 way with centre OFF, 6A/440V. **3 Phase wound Rotor & Sync. Motor panel --1 No.** • Rotor resistors of 30E/5A with 3 taps of 15E, 21E, 30E each - 3 Nos. • Rotor resistor selector switch, 3 pole. 6 Way 6A/440 V. • DC Rotor excitation with circuit breaker (3Amp) • 1 ph. Motor, Alternator & Sync. Motor Panel • 1 ph. MCBs of 4A/1.6A 1 each. • 2 no. 2P2W selector switches to run as 1ph. alternator then as synchronous motor. • 8A pushbutton switch to simulate as centrifugal switch. • 1 No. lamp holder with input sockets **DC voltmeter & DC ammeter panel 1 No.** a) DC voltmeter(0-300V) b) DC Ammeter (0-5A) with polarity protection diode c) Field failure relay to control Armature supply.												

	d) 4A Circuit Breaker. • **SCR Actuator (variable DC) cum sensor signal conditioning panel** **--3 Nos** • Full bridge SCR based 0V-195V / 3 Amp cosine firing with linear characteristics. • Supports signal conditioning circuit for speed, torque in kg. to give output 0-2.5Vdc (FS). 3 Nos. of these supplies required for DC Armature, DC motor field & AC generator field. • Provided with built in P/PI controller to keep DC motor (prime mover) speed constant while synchronizing 3 coupled 3 phase alternator with grid / other 3 phase alternator. **Instrumentation Power supply cum Multichannel DPM panel 1 No.** (a) +/-12 V, 500 mA (b) +5V, 300mA (c) Unregulated 17V dc/750 mA (d) line synchronizing signal. (e) Multi channel DPM for digital display of torque, speed etc **Resistor Load Panel 1 No.** Should have off position to run on no load. (1)**AC Resistors** = 10K/200WX3 phases/ 6 steps (2) **DC Resistors** = 750E/400W / 6 steps **LC Load panel 1 No.** (A) Inductive load = 0.15H/0.3H/0.45H/0.6H/0.75H/1.5H/3H/400mAX3Nos. (B) Capacitive load =1.25µ/2.5µ/5µ/415VX 3Nos. **Variable AC & DC Supply Panel** Variable O/P : AC 0-270V/3A Variable O/P : DC 0-250V/3A **Following Essential accessories should be provided with trainer**: A) Hand held tacho meter – 1 No. B) Shrouded patch chord – 118												

	C) Well written students workbook explaining at least 50 experiments with instructor guide. – 1 No. D) Demo CD to help student to work by themselves – 1 No. **A. PC interface needs following additional panels:** **1) AC Multi parameter measurement meter (MMM)/Power Network analyzer** • These MMM meters replace above since they offer modbus connectivity. • Modbus RS485 to USB converter needed – 2nos. **2) DC Current /Voltage Measurement Expt. Panel** • DC current hall sensor (x2nos.): Closed Loop current measurement using Hall sensor IC (max. I/P upto 20A, 50/60Hz), Isolation = 2.1KV, Proportional O/P = 0 - 2.5V, 1 CH. • DC Voltage transducer (x2 nos): Using high speed opto coupler IC (max. up to 600Vdc), isolation = 2 KV, 1 CH. • Function Blocks Used : Precision rectifier (x 2 nos) with gain = 5, LPF (x2nos) with gain = 2, Span Zero Circuit to interface with ADC(0-2.5Vdc) for both current & voltage, only 1 functional block each supplied, 2nd , Field failure/zero current detector. Needs CIP panel to interface with PC USB port. **3) Computer Interface panel**• Connects to PC USB port using USB IO module through 25 pin D (M) connector on CIP & type A to mini B cable. • 4 ADC channels I/P: 0 to 2.5V FS with 1no input simulation pot. 1 DAC channel O/P 2.5V FS. • V to I function block: I/P 0 to 2.5V & O/P 0-20 or 4-20mA (100E load) switch settable. • I to V function block : I/P 4 to 20mA & O/P 0 - 2.5V												

	4) Software on CD: • Virtual Workbench package is a USB / serial modbus based software working on windows dot Net platform coupled with USB IO module useful as general purpose utility which supports different control strategies like Single or multi loop PID controllers, Fuzzy controller etc, Graph plotting in XY, XT & polar mode etc, Modbus interface, Data logging, Event trigger, inbuilt Function generator etc **a. DC Integrated machine 1 No.** Voltage : Varm = 180V, Vfield = 180V Capacity/RP M/Terminals : 300W / 2 Pole m/c / 1500RPM 6 terminals Rotor Construction : Should be Standard commutator / brush arrangement with laminated stack, brought out on 2 terminals Stator Construction : separately excited field winding with laminated pole solid yoke & series winding brought out on 4 terminals Chasis mounted, 19mm dia, trunion mounted Machine for use as Dynamometer with torque & speed sensors. Must be able to work as shunt/series/compound motor as well as generator. **b DC integrated m/c [Foot Mounted] -1 No.** Voltage : Varm = 180V, Vfield = 180V Capacity/RP M/Terminals : 300W / 2 Pole m/c / 1500RPM 6 terminals Rotor Construction : Should be Standard commutator / brush arrangement with laminated stack, brought out on 2 terminals Stator Construction : separately excited field winding with												

	laminated pole solid yoke & series winding brought out on 4 terminals **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
35.	**3 Phase squirrel cage induction motor trainer** **SALIENT FEATURES** • Facilitates easy & safe wiring by students due to use of 4mm sturdy shrouded banana patch cords & shrouded socket arrangements. • All machines are mounted on finely painted sturdy base frame. • With due emphasis on student safety machines operate upto 300W power levels & upto 1500 RPM, without compromising didactic use Able to draw all graphs. • Brake pulley arrangement for variable loading of motor. • Set of Students Workbook & Instructors Guide. **A] Motor Specifications** **3 Phase Squirrel cage Induction motor : -** Voltage: 415VAC, 50Hz, Capacity: 300W/4 pole/ 1500RPM/12 terminals, Rotor construction: Diecast Squirrel cage rotor, Stator construction: 6X2 terminals brought out to run machine at two speeds using pole changing method (Dahellander winding) Frame/mounting: 100 frame, chassis mounted, 19mm shaft dia. Loading arrangement: Friction brake pulley	2	1	0	0	0	0	1	0	1	5	

	(60.5mm dia) for loading arrangement with 20Kg spring balance for torque measurement. Speed Measurement: Using hand held tachometer. **B]Control Panel Specifications** Aluminum profile (4X1) sturdy Modular flat panel (table top) system, carrying various high voltage components housed in plastic enclosures (panel) to minimise shock possibility. **Input 3 phase DOL Starter panel** • 4 pole MCB of 415 V/4A. • DOL 9A Contactor with 230V / 50 Hz / 11VA Coil . • Bimetallic thermal O/L relay with range 1.4A - 2.3A . • R-Y-B Input Indicators. **Integrated AC 3 phase multifunction measurement panel Bidirectional Multifunction** • 3 Phase ¾ wire, 415V, CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V,I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 **FWD-OFF-REV Switch panel** • FWD/REV, 3 pole 3 way switch with centre OFF, 6A/440V. • Accessories : Hand held digital Tachometer, 3 Ph. / 3A variac **List of Experiments** 1) Speed torque characteristics of 3 phase squirrel cage induction motor. 2) Efficiency, % slip & input power factor measurement of 3 phase squirrel cage induction motor. 3) Speed control of Squirrel Cage Induction motor by pole changing method.												

	4) 'No Load Test' & 'Blocked Rotor Test' on 3 Ph. squirrel cage induction motor. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
36.	**Single Phase AC Induction Motor Trainer** **FEATURES:** • Facilitates easy & safe wiring by students due to use of 4mm sturdy shrouded banana patch cords & shrouded socket arrangements. • Machines should be mounted on finely painted sturdy base frame • With due emphasis on student safety machines should operate upto 300W power levels & upto 1500 RPM, without compromising didactic use Able to draw all graphs. • Break pulley arrangement for variable loading of motor should be provided. **MOTOR SPECIFICATIONS** 1Ph AC Integrated motor Voltage: 230VAC, 50Hz, Capacity: 300W/4 pole/ 1500RPM/ 10 terminals, Rotor construction: Diecast squirrel cage Rotor, Stator construction: Two windings should be brought out on 4 terminals for main & auxiliary, these will be used to configure different motors split phase, CSCR, CSIR, Frame/mounting: 100 frame, chassis mounted, 19 mm	2	1	0	0	0	0	1	0	1	5	

	shaft dia. Loading arrangement: Friction break pulley (60.5mm dia) for loading arrangement with 20Kg spring balance for torque measurement. Speed Measurement: Using hand held tachometer. **CONTROL PANEL SPECIFICATIONS** A] Aluminum profile sturdy flat panel (table top) system, carrying various high voltage components housed in plastic enclosures (panel) to minimize shock possibility. **1 ph. Motor, Alternator & Sync. Motor Panel** • 1 ph. MCBs of 4A/1.6A 1 each. • Bulb Load. **Integrated AC 1 phase multifunction measurement panel** • Should Consist of 1 nos of (96X96mm) Digital meter for 1 Measures V, I, PF (0.2 lag - unity 0.2 lead), W, VA, VAR, Hz etc.) • Current specs for 1 meter = 5A. • Auxiliary supply = 170-250VAC **3 Phase wound Rotor & Sync. Motor panel** • Rotor resistors of 30E/5A with 3 taps of 0E, 15E, 21E, 30E (each 3 nos.) • Rotor resistor selector switch, 3 pole 6 Way 6A/440 V. • DC Rotor excitation over current Circuit Breaker (3Amp) **FOLLOWING LIST OF EXPERIMENTS SHOULD BE PERFORMED WITH THE TRAINER :** 1) Study of Speed-Torque Characteristics of 1 Phase induction motor (Split phase type). 2) Study of Efficiency & Input power factor of 1 Phase induction motor (Split phase type) for various loading												

	conditions. 3) Study of Speed-Torque Characteristics of 1 Phase Induction Motor (Capacitor Start Type) 4) Study of Efficiency & Input Power factor of 1 Phase induction motor (Capacitor Start Type) for various loading conditions. 5) Study of Speed -Torque Characteristics of 1 Phase Induction Motor (Capacitor Start-Run Type). 6) Study of Efficiency & Input power factor of 1 Phase induction motor (Capacitor Start-Run Type) for various loading conditions. 7) Study *NO LOAD TEST* & *BLOCKED ROTOR TEST* on 1 Phase induction motor. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**												
37.	**DC motor coupled to 3 ph AC motor trainer** **Features :** • Should have 4mm sturdy shrouded banana patch cords & shrouded arrangements. • All machines should be mounted on finely painted sturdy base frame with easy machine Interchange ability. • Should be able to draw all graphs	**1**	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**1**	**5**		

	• Machines should operate upto 300W power levels & upto 1500 RPM. • Must use Trunnion mounted DC machine as Dynamometer for loading other machines with facility to measure shaft power using electronic torque / speed measurement • One Dynamometer type DC m/c per Aluminum Rack with multiple panels **A) Technical Specifications of interfacing panel rack - 1 No.** Powder coated Sturdy aluminums Flat panel system made up of Alluminium extruded profiles carrying various high voltage components housed in plastic enclosures to minimize shock possibility. Should be able to hold following control panels with colorful overlay. • **Trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there & shrouded 4 mm banana patch cords & shrouded sockets arrangements for the safety of the students** **B) Each control panel rack consists of : -** **Input 3 phase DOL Starter panel** [10 Shrouded Banana] **1 No.** •4 pole MCB of 415 V/4A . •DOL 9A Contactor with 230V / 50 Hz / 11VA COIL . •Bimetallic thermal O/L relay with range 1.4A - 2.3A . **Integrated AC (1 phase) measurement panel 1 No.** . •Bidirectional Multifunction Meter •3 Phase 3/4 wire, 415V, CT Input 5A •LCD/LED display, Aux supply 230V, 45-65 Hz, 5W													

	•V.I., Hz, Pf, KVA, KW,KWH Modbus RTU RS 485 **3 Ph. Bidirectional power cum Energy meter panel --1 No.** • Bidirectional Multifunction • 3 Phase ¾ wire, 415V, CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V,I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 **FWD/REV, Star-Delta starter panel --1 No.** • FWD/REV, 3 pole 3 way switch with centre OFF, 6A/440V. • Star/Delta switch 3 pole, 3 way with centre OFF, 6A/440V. **3 Phase wound Rotor & Sync. Motor panel --1 No.** • Rotor resistors of 30E/5A with 3 taps of 15E, 21E, 30E each - 3 Nos. • Rotor resistor selector switch, 3 pole. 6 Way 6A/440 V. • DC Rotor excitation with circuit breaker (3Amp) • 1 ph. Motor, Alternator & Sync. Motor Panel • 1 ph. MCBs of 4A/1.6A 1 each. • 2 no. 2P2W selector switches to run as 1ph. alternator then as synchronous motor. • 8A pushbutton switch to simulate as centrifugal switch. • 1 No. lamp holder with input sockets **DC voltmeter & DC ammeter panel 1 No.** a) DC voltmeter(0-300V) b) DC Ammeter (0-5A) with polarity protection diode c) Field failure relay to control Armature supply. d) 4A Circuit Breaker. • **SCR Actuator (variable DC) cum sensor signal conditioning panel --3 Nos** • Full bridge SCR based 0V-195V / 3 Amp cosine firing with linear characteristics. • Supports signal conditioning circuit for speed, torque in kg. to give output 0-2.5Vdc (FS).												

	3 Nos. of these supplies required for DC Armature, DC motor field & AC generator field. • Provided with built in P/PI controller to keep DC motor (prime mover) speed constant while synchronizing 3 coupled 3 phase alternator with grid / other 3 phase alternator. **Instrumentation Power supply cum Multichannel DPM panel 1 No.** (a) +/-12 V, 500 mA (b) +5V, 300mA (c) Unregulated 17V dc/750 mA (d) line synchronizing signal. (e) Multi channel DPM for digital display of torque, speed etc **Resistor Load Panel 1 No.** Should have off position to run on no load. (1)**AC Resistors** = 10K/200WX3 phases/ 6 steps (2) **DC Resistors** = 750E/400W / 6 steps **LC Load panel 1 No.** (A) Inductive load = 0.15H/0.3H/0.45H/0.6H/0.75H/1.5H/3H/400mAX3Nos. (B) Capacitive load =1.25μ/2.5μ/5μ/415VX 3Nos. **Variable AC & DC Supply Panel** Variable O/P : AC 0-270V/3A Variable O/P : DC 0-250V/3A **Following Essential accessories should be provided with trainer**: A) Hand held tacho meter – 1 No. B) Shrouded patch chord – 118 C) Well written students workbook explaining at least 50 experiments with instructor guide. – 1 No. D) Demo CD to help student to work by themselves – 1 No. **A. PC interface needs following additional panels:** **1) AC Multi parameter measurement meter (MMM)/Power Network analyzer**													

	• These MMM meters replace above since they offer modbus connectivity. • Modbus RS485 to USB converter needed – 2nos. **2) DC Current /Voltage Measurement Expt. Panel** • DC current hall sensor (x2nos.): Closed Loop current measurement using Hall sensor IC (max. I/P upto 20A, 50/60Hz), Isolation = 2.1KV, Proportional O/P = 0 - 2.5V, 1 CH. • DC Voltage transducer (x2 nos): Using high speed opto coupler IC (max. up to 600Vdc), isolation = 2 KV, 1 CH. • Function Blocks Used : Precision rectifier (x 2 nos) with gain = 5, LPF (x2nos) with gain = 2, Span Zero Circuit to interface with ADC(0-2.5Vdc) for both current & voltage, only 1 functional block each supplied, 2nd , Field failure/zero current detector. Needs CIP panel to interface with PC USB port. **3) Computer Interface panel**• Connects to PC USB port using USB IO module through 25 pin D (M) connector on CIP & type A to mini B cable. • 4 ADC channels I/P: 0 to 2.5V FS with 1no input simulation pot. 1 DAC channel O/P 2.5V FS. • V to I function block: I/P 0 to 2.5V & O/P 0-20 or 4-20mA (100E load) switch settable. • I to V function block : I/P 4 to 20mA & O/P 0 - 2.5V **4) Software on CD:** • Virtual Workbench package is a USB / serial modbus based software working on windows dot Net platform coupled with USB IO module useful as general purpose utility which supports different control strategies like Single or multi loop PID controllers, Fuzzy controller etc, Graph plotting in XY, XT & polar mode etc, Modbus interface, Data logging, Event trigger, inbuilt												

	Function generator etc **a. DC Integrated machine 1 No.** Voltage : Varm = 180V, Vfield = 180V Capacity/RP M/Terminals : 300W / 2 Pole m/c / 1500RPM 6 terminals Rotor Construction : Should be Standard commutator / brush arrangement with laminated stack, brought out on 2 terminals Stator Construction : separately excited field winding with laminated pole solid yoke & series winding brought out on 4 terminals Chasis mounted, 19mm dia, trunion mounted Machine for use as Dynamometer with torque & speed sensors. Must be able to work as shunt/series/compound motor as well as generator. **b. 3 Phase AC Integrated m/c - 1 No.** Voltage : 415VAC, 50Hz Capacity/RP M/Terminals : 300W / 4 Pole m/c / 1500RPM 10 terminals Rotor Construction : must be Star connected, four terminals including star point brought out on 4 slip rings mounted on shaft. Stator Construction: Six terminals to be brought out to start the machine using STAR - DELTA Starter. Chasis mounted, 19mm dia, Application: Must work as slip ring wound rotor I.M, synchronous motor, & synchronous generator. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not**												

	close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.											
38.	**3 phase AC integrated motor coupled to DC integrated motor setup (Motor-Generator setup):** **Features :** • Should have 4mm sturdy shrouded banana patch cords & shrouded arrangements. • All machines should be mounted on finely painted sturdy base frame with easy machine Interchange ability. • Should be able to draw all graphs • Machines should operate upto 300W power levels & upto 1500 RPM. • Must use Trunnion mounted DC machine as Dynamometer for loading other machines with facility to measure shaft power using electronic torque / speed measurement • One Dynamometer type DC m/c per Aluminum Rack with multiple panels **A) Technical Specifications of interfacing panel rack - 1 No.** Powder coated Sturdy aluminums Flat panel system made up of Alluminium extruded profiles carrying various high voltage components housed in plastic enclosures to minimize shock possibility. Should be able to hold following control panels with colorful overlay. • **Trainer should be modular panels for easy site**	**1**	**0**	**1**	**0**	**0**	**1**	**1**	**0**	**1**	**5**	

	servicing not close control; panel box no wiring should not be there & shrouded 4 mm banana patch cords & shrouded sockets arrangements for the safety of the students **B) Each control panel rack consists of : -** **Input 3 phase DOL Starter panel** [10 Shrouded Banana] **1 No.** •4 pole MCB of 415 V/4A . •DOL 9A Contactor with 230V / 50 Hz / 11VA COIL . •Bimetallic thermal O/L relay with range 1.4A - 2.3A . **Integrated AC (1 phase) measurement panel 1 No.** . •Bidirectional Multifunction Meter •3 Phase 3/4 wire, 415V, CT Input 5A •LCD/LED display, Aux supply 230V, 45-65 Hz, 5W •V.I., Hz, Pf, KVA, KW,KWH Modbus RTU RS 485 **3 Ph. Bidirectional power cum Energy meter panel --1 No.** • Bidirectional Multifunction • 3 Phase ¾ wire, 415V, CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V,I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 **FWD/REV, Star-Delta starter panel --1 No.** • FWD/REV, 3 pole 3 way switch with centre OFF, 6A/440V. • Star/Delta switch 3 pole, 3 way with centre OFF, 6A/440V. **3 Phase wound Rotor & Sync. Motor panel --1 No.** • Rotor resistors of 30E/5A with 3 taps of 15E, 21E, 30E each - 3 Nos. • Rotor resistor selector switch, 3 pole. 6 Way 6A/440 V. • DC Rotor excitation with circuit breaker (3Amp) • 1 ph. Motor, Alternator & Sync. Motor Panel • 1 ph. MCBs of 4A/1.6A 1 each.												

	• 2 no. 2P2W selector switches to run as 1ph. alternator then as synchronous motor. • 8A pushbutton switch to simulate as centrifugal switch. • 1 No. lamp holder with input sockets **DC voltmeter & DC ammeter panel 1 No.** a) DC voltmeter(0-300V) b) DC Ammeter (0-5A) with polarity protection diode c) Field failure relay to control Armature supply. d) 4A Circuit Breaker. • **SCR Actuator (variable DC) cum sensor signal conditioning panel** **--3 Nos** • Full bridge SCR based 0V-195V / 3 Amp cosine firing with linear characteristics. • Supports signal conditioning circuit for speed, torque in kg. to give output 0-2.5Vdc (FS). 3 Nos. of these supplies required for DC Armature, DC motor field & AC generator field. • Provided with built in P/PI controller to keep DC motor (prime mover) speed constant while synchronizing 3 coupled 3 phase alternator with grid / other 3 phase alternator. **Instrumentation Power supply cum Multichannel DPM panel 1 No.** (a) +/-12 V, 500 mA (b) +5V, 300mA (c) Unregulated 17V dc/750 mA (d) line synchronizing signal. (e) Multi channel DPM for digital display of torque, speed etc **Resistor Load Panel 1 No.** Should have off position to run on no load. (1)**AC Resistors** = 10K/200WX3 phases/ 6 steps (2) **DC Resistors** = 750E/400W / 6 steps **LC Load panel 1 No.** (A) Inductive load = 0.15H/0.3H/0.45H/0.6H/0.75H/1.5H/3H/400mAX3Nos.												

	(B) Capacitive load =1.25μ/2.5μ/5μ/415VX 3Nos. **Variable AC & DC Supply Panel** Variable O/P : AC 0-270V/3A Variable O/P : DC 0-250V/3A **Following Essential accessories should be provided with trainer:** A) Hand held tacho meter – 1 No. B) Shrouded patch chord – 118 C) Well written students workbook explaining at least 50 experiments with instructor guide. – 1 No. D) Demo CD to help student to work by themselves – 1 No. **A. PC interface needs following additional panels:** **1) AC Multi parameter measurement meter (MMM)/Power Network analyzer** • These MMM meters replace above since they offer modbus connectivity. • Modbus RS485 to USB converter needed – 2nos. **2) DC Current /Voltage Measurement Expt. Panel** • DC current hall sensor (x2nos.): Closed Loop current measurement using Hall sensor IC (max. I/P upto 20A, 50/60Hz), Isolation = 2.1KV, Proportional O/P = 0 - 2.5V, 1 CH. • DC Voltage transducer (x2 nos): Using high speed opto coupler IC (max. up to 600Vdc), isolation = 2 KV, 1 CH. • Function Blocks Used : Precision rectifier (x 2 nos) with gain = 5, LPF (x2nos) with gain = 2, Span Zero Circuit to interface with ADC(0-2.5Vdc) for both current & voltage, only 1 functional block each supplied, 2nd , Field failure/zero current detector.											

	Needs CIP panel to interface with PC USB port. **3) Computer Interface panel•** Connects to PC USB port using USB IO module through 25 pin D (M) connector on CIP & type A to mini B cable. • 4 ADC channels I/P: 0 to 2.5V FS with 1no input simulation pot. 1 DAC channel O/P 2.5V FS. • V to I function block: I/P 0 to 2.5V & O/P 0-20 or 4-20mA (100E load) switch settable. • I to V function block : I/P 4 to 20mA & O/P 0 - 2.5V **4) Software on CD:** • Virtual Workbench package is a USB / serial modbus based software working on windows dot Net platform coupled with USB IO module useful as general purpose utility which supports different control strategies like Single or multi loop PID controllers, Fuzzy controller etc, Graph plotting in XY, XT & polar mode etc, Modbus interface, Data logging, Event trigger, inbuilt Function generator etc **a. DC Integrated machine 1 No.** Voltage : Varm = 180V, Vfield = 180V Capacity/RP M/Terminals : 300W / 2 Pole m/c / 1500RPM 6 terminals Rotor Construction : Should be Standard commutator / brush arrangement with laminated stack, brought out on 2 terminals Stator Construction : separately excited field winding with laminated pole solid yoke & series winding brought out on 4 terminals Chasis mounted, 19mm dia, trunion mounted Machine for use as Dynamometer with torque & speed sensors. Must be able to work as shunt/series/compound motor as well as generator.												

	b. 3 Phase AC Integrated m/c - 1 No. Voltage : 415VAC, 50Hz Capacity/RP M/Terminals : 300W / 4 Pole m/c / 1500RPM 10 terminals Rotor Construction : must be Star connected, four terminals including star point brought out on 4 slip rings mounted on shaft. Stator Construction: Six terminals to be brought out to start the machine using STAR - DELTA Starter. Chasis mounted, 19mm dia, Application: Must work as slip ring wound rotor I.M, synchronous motor, & synchronous generator. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
39.	**Electrical Load power factor Trainer (APFC)** **Features:** • Should have 4mm sturdy shrouded banana patch cords & shrouded arrangements. • Each panel should have ABS molded plastic sturdy enclosure, & colorful screwless overlays showing circuits diagrams & its connection tag numbers for easy understanding & connection • The trainer should consist of built in requisite relay testing kit typically consisting of voltage injector, current	1	0	1	1	1	1	1	0	0	6	

	injector, elapsed time counter (1 msec resolution), trip relay logic etc. • Should Facilitates easy & safe wiring by students due to use of 4mm sturdy Shrouded banana patch cords & shrouded socket arrange-ments for high voltage circuits • Each panel Should have ABS molded plastic sturdy enclosure, & colorful screwless overlays showing circuits diagrams & its connection tag numbers for easy understanding & connection **Technical Specifications** Aluminum profile sturdy Flat panel system carrying various high voltage components housed in plastic enclosures to minimize shock possibility. **Input 3 phase DOL Starter panel** Should consists of • 4 pole MCB of 415 V/2A . • DOL 9A Contactor with 230V / 50 Hz / 11VA COIL . • Bimetallic thermal O/L relay with range 1.4A - 2.3A . **3 Phase Power cum Energy meter panel** • Multifunction • 3 phase 3/4 wire, 415VAC, CT Input 5A • LCD/LED display, Aux. supply 230V, 45-65Hz,5W, • V, I, Hz, Pf, KVA, KW, KWH. • Modbus RTU RS 485 **FWD-OFF-REV, Switch Panel** FWD/REV, 3 pole 3 way switch with center OFF, 6A/440V **1 phase AC input supply panel** Should consists of • 1 phase MCB of 4A/1.6A - 2 nos. • Bulb load **Contractor panel X 4 nos**												

	• 9A Contactor with 230V / 50 Hz / 11VA COIL with 3 nos NO type power contact • 2 NO, 2 NC logic contacts. **Lamp indicator / Toggle switch Load Panel x 2 Nos.** Each panel should consists of 230V /15/40/60/100W X 3 lamp indicators & 3 nos. of toggle switches. **PFCR relay** • It should have 8 Nos. of NO contact. Power Factor Control range should be from 0.8 lag to 0.8 lead. • Current coil • Auxiliary supply : 415VAC 50Hz • Mode : Auto & Manual **The above trainer should cover following experiment:** To perform experiment to control load power factor **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
40.	**Complete House Wiring Installation Trainer** **Technical Specifications:** The Trainer should have Aluminum profile sturdy Modular flat panel (table top) system, carrying various high voltage components housed in plastic enclosures (panel) to minimise shock possibility It should consists of :	**0**	**0**	**1**	**0**	**1**	**2**	**0**	**0**	**0**	**4**	

	•1 ph. AC input supply •1 ph. MCBs of 4A/1.6A - 2nos. **Grounding & protection panel** • Consists of a 2 pole Earth Leakage Circuit Breaker (ELCB) 25A with current imbalance of 30mA. • One NO push button to create Earth leakage fault. • One SPDT to select HI- leakage or LO-leakage fault. • One 15W bulb for Hi-Leakage fault & 22KW resistor for Lo leakage fault. **Integrated AC (1 phase) measurement panel** • 1 nos of Digital meter for 1 ph. parameters V, I, PF, W, Wh, VA, VAR, Hz, etc. • Current specs = 1A/5A for 1ph. meter (170-250V). **AC Power supply panel** • AC OSARAM power supply for metal halide lamp 70W (max. 5KV) • Input 230VAC/0.4A **DC Power** supply panel • SMPS power supply for LED • Input 230VAC, Output +12V/5A, 60W • DC supply for down lighter **Switches panel** • One way switch = 2 nos • Two way switch = 2 nos **Buzzer/bell switch/ Neon panel** • Buzzer/Bell, I/P 230VAC												

	• Bell switch • Neon lamp indicator • Kitkat fuse **Dimmer/Fault panel** • Dimmer • fault = 2 nos **Sockets panel** • Three pin AC mains Sockets = 3 nos • 230V/10A rating **DP switch panel** • Double pole single through four terminal S/W= 2nos • Rating 32A/240VAC **Lamp panel** • Incandescent lamp = 1 no, CFL tube = 1 no **Various Lamp/Tubes provided** • Metal Halide lamp (70W) • Electronic tube • Point source LED • Strip LED **Display panel** showing various wiring accessories • Conduit, Elbow joints, casing taping, • Cleats, Batten with clips, cable/wires etc. **Wiring practice board** A replaceable 20mm particle board is mounted vertically												

	on profiles in front of lower row of panel. The inclination of the board is settable from near vertical position to near horizontal position & it is used for wiring practice by students using self-tapping screws & wiring accessories. **Following accessories should be provided.** Drill Machine, screw driver se, self-tapping screws, drill bits. **The Trainer should be capable of performing following experiments.** 1. Electrical Safety Rules for working in laboratories 2. Variety of wiring experiments based on above operational panels 3. Study of Protective Devices Panel 4. Study & use of Measurement Devices 5. Understanding working of various types of lamps including tube, led & other high intensity lamps 6. Hands on wiring practice using cables, casing & hand tools **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**												
41.	**3 Phase squirrel cage induction motor trainer** **SALIENT FEATURES** • Facilitates easy & safe wiring by students due to use of	**0**	**1**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**2**		

	4mm sturdy shrouded banana patch cords & shrouded socket arrangements. • All machines are mounted on finely painted sturdy base frame. • With due emphasis on student safety machines operate upto 300W power levels & upto 1500 RPM, without compromising didactic use Able to draw all graphs. • Brake pulley arrangement for variable loading of motor. • Set of Students Workbook & Instructors Guide. **A] Motor Specifications** **3 Phase Squirrel cage Induction motor : -** Voltage: 415VAC, 50Hz, Capacity: 300W/4 pole/ 1500RPM/12 terminals, Rotor construction: Diecast Squirrel cage rotor, Stator construction: 6X2 terminals brought out to run machine at two speeds using pole changing method (Dahellander winding) Frame/mounting: 100 frame, chassis mounted, 19mm shaft dia. Loading arrangement: Friction brake pulley (60.5mm dia) for loading arrangement with 20Kg spring balance for torque measurement. Speed Measurement: Using hand held tachometer. **B]Control Panel Specifications** Aluminum profile (4X1) sturdy Modular flat panel (table top) system, carrying various high voltage components housed in plastic enclosures (panel) to minimise shock possibility. **Input 3 phase DOL Starter panel** • 4 pole MCB of 415 V/4A. • DOL 9A Contactor with 230V / 50 Hz / 11VA Coil . • Bimetallic thermal O/L relay with range 1.4A - 2.3A . • R-Y-B Input Indicators.												

	Integrated AC 3 phase multifunction measurement panel Bidirectional Multifunction • 3 Phase ¾ wire, 415V, CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V,I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 **FWD-OFF-REV Switch panel** • FWD/REV, 3 pole 3 way switch with centre OFF, 6A/440V. • Accessories : Hand held digital Tachometer, 3 Ph. / 3A variac **List of Experiments** 1) Speed torque characteristics of 3 phase squirrel cage induction motor. 2) Efficiency, % slip & input power factor measurement of 3 phase squirrel cage induction motor. 3) Speed control of Squirrel Cage Induction motor by pole changing method. 4) 'No Load Test' & 'Blocked Rotor Test' on 3 Ph. squirrel cage induction motor. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
42.	**Control of 3 Ph. Squirrel Cage Induction Motor Trainer**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	

	SALIENT FEATURES • Easy & safe wiring by students due to 4mm sturdy shrouded banana patch cords & shrouded socket arrangement for high voltage circuits. • Facilitates easy learning about operative characteristics of ubiquitous squirrel cage induction motor. • Each panel has ABS molded plastic sturdy enclosure, & colorful screw less overlays showing circuit diagram & its connection tag numbers for easy understanding & connections. • Set of Instructor Guide & Student Workbook. **Technical Specifications** Aluminum profile sturdy Modular flat demo panel system (table top), carrying various high voltage components housed in plastic enclosures (panel) to minimize shock possibility. **1) 1 ph. Motor, Alternator & Sync. Motor Panel** 1 ph. MCBs of 4A/1.6A - 2nos, bulb load. **2) Integrated AC (1 phase) measurement panel** • Bidirectional Multifunction Meter • 3 Phase 3/4 wire, 415V, CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V.I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 **3) AC voltmeter panel** • Voltage range : 300V • 1 pole 4 way switch to select line voltage for three phase **4) Dual range AC ammeter panel** • Current range:2A/6A selectable . • 1 pole 7 way switch to select phase current for three phase												

	5) IGBT Controlled AC Drive panel 1) Input voltage: 230VAC. 50Hz 2) Output voltage: 3 phase 200 to 230VAC 3) Range (Frequency Control) : 0.1 Hz to 100 (400)Hz 4) Control Mode :Sine Wave PWM 5) Capacity : ½ HP 6) With Reverse & Forward Direction 7) Mech: single width for ½ HP **6) Motor specifications :** 3 phase squirrel cage induction motor, ½ HP 4 pole, 1500RPM, 6 terminal (delta 220Vac/star 440Vac) motor with Hand held Tachometer for speed measurement **7) List of Experiments :** • Study of Speed-Torque Characteristics of 3 Ph. Squirrel Cage Induction Motor & to verify constant v/f ratio • [VFD I/P = 230VAC L-N, O/P=220VAC L-L] • Study of Speed-Torque Characteristics of 3 Ph. Squirrel Cage Induction Motor & to verify constant v/f • Study of efficiency of AC motor. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
43.	**3 phase slip ring induction motor trainer** **FEATURES** • Facilitates easy & safe wiring by students due to use of	**0**	**1**	**1**	**1**	**0**	**0**	**1**	**0**	**0**	**4**	

	4mm sturdy shrouded banana patch cords & shrouded socket arrangements. • Machines should be mounted on finely painted sturdy base frame . • With due emphasis on student safety machines should operate upto 300W power levels & upto 1500 RPM, without compromising didactic use Able to draw all graphs. • Break pulley arrangement for variable loading of motor should be provided **MOTOR SPECIFICATIONS** **3 ph. AC Integrated motor with following specs**: Voltage: 415VAC, 50Hz, Capacity: 300W/4 pole/ 1500RPM, Rotor construction: Star connected, four terminals including star point brought out on 4 slip rings mounted on shaft, Stator construction: Six terminal should be brought out to start the machine using star-delta starter, Frame/mounting: 100 frame, chassis mounted, 19mm shaft dia. Loading arrangement: Friction break pulley (60.5mm dia) for loading arrangement with 20Kg spring balance for torque measurement. Speed Measurement: Using hand held tachometer. **CONTROL PANEL SPECIFICATIONS** A] Aluminum profile sturdy flat panel (table top) system, carrying various high voltage components housed in plastic enclosures (panel) to minimise shock possibility. **Input 3 phase DOL Starter panel** • 4 pole MCB of 415 V/4A. • DOL 9A Contactor with 230V / 50 Hz / 11VA COIL. • Bimetallic thermal O/L relay with range 1.4A - 2.3A . **Integrated AC 3 phase multifunction measurement**												

	(f) Multi channel DPM for digital display of torque, speed etc **FOLLOWING LIST OF EXPERIMENTS SHOULD BE PERFORMED WITH THE TRAINER :** 1) Speed torque characteristics of 3 wound rotor induction motor with variable rotor resistance. 2) Efficiency & input power factor measurement of 3 wound rotor induction motor. 3) Speed torque characteristics of 3 short-circuited rotor induction motor. 4) Efficiency & input power factor measurement of 3 short-circuited rotor induction motor. 5) Speed torque characteristics of Three Phase synchronous motor. 6) Efficiency & input power factor measurement of Three-phase Synchronous Motor 7) Use of synchronous motor as power factor improvement device. Study of 'V' curves 8) Study of Direct On Line (DOL) starter for Three-Phase induction motor 9) Study of star-delta starter for 3 induction motor. 10) Study of rotor resistance starter for 3 wound rotor induction motor. 11) Study of direction of reversal for 3 induction motor. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**												

44.	**1 PH. AC INDUCTION MOTOR TRAINER** **FEATURES:** • Facilitates easy & safe wiring by students due to use of 4mm sturdy shrouded banana patch cords & shrouded socket arrangements. • Machines should be mounted on finely painted sturdy base frame • With due emphasis on student safety machines should operate upto 300W power levels & upto 1500 RPM, without compromising didactic use Able to draw all graphs. • Break pulley arrangement for variable loading of motor should be provided. **MOTOR SPECIFICATIONS** 1Ph AC Integrated motor Voltage: 230VAC, 50Hz, Capacity: 300W/4 pole/ 1500RPM/ 10 terminals, Rotor construction: Diecast squirrel cage Rotor, Stator construction: Two windings should be brought out on 4 terminals for main & auxiliary, these will be used to configure different motors split phase, CSCR, CSIR, Frame/mounting: 100 frame, chassis mounted, 19 mm shaft dia. Loading arrangement: Friction break pulley (60.5mm dia) for loading arrangement with 20Kg spring balance for torque measurement. Speed Measurement: Using hand held tachometer. **CONTROL PANEL SPECIFICATIONS** A] Aluminum profile sturdy flat panel (table top) system, carrying various high voltage components housed in	2	1	0	0	0	0	0	0	0	3	

	plastic enclosures (panel) to minimize shock possibility. **1 ph. Motor, Alternator & Sync. Motor Panel** • 1 ph. MCBs of 4A/1.6A 1 each. • Bulb Load. **Integrated AC 1 phase multifunction measurement panel** • Should Consist of 1 nos of (96X96mm) Digital meter for 1 Measures V, I, PF (0.2 lag - unity 0.2 lead), W, VA, VAR, Hz etc.) • Current specs for 1 meter = 5A. • Auxiliary supply = 170-250VAC **3 Phase wound Rotor & Sync. Motor panel** • Rotor resistors of 30E/5A with 3 taps of 0E, 15E, 21E, 30E (each 3 nos.) • Rotor resistor selector switch, 3 pole 6 Way 6A/440 V. • DC Rotor excitation over current Circuit Breaker (3Amp) **FOLLOWING LIST OF EXPERIMENTS SHOULD BE PERFORMED WITH THE TRAINER :** 1) Study of Speed-Torque Characteristics of 1 Phase induction motor (Split phase type). 2) Study of Efficiency & Input power factor of 1 Phase induction motor (Split phase type) for various loading conditions. 3) Study of Speed-Torque Characteristics of 1 Phase Induction Motor (Capacitor Start Type) 4) Study of Efficiency & Input Power factor of 1 Phase induction motor (Capacitor Start Type) for various loading conditions. 5) Study of Speed -Torque Characteristics of 1 Phase												

	Induction Motor (Capacitor Start-Run Type). 6) Study of Efficiency & Input power factor of 1 Phase induction motor (Capacitor Start-Run Type) for various loading conditions. 7) Study NO LOAD TEST & BLOCKED ROTOR TEST on 1 Phase induction motor. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
45.	**3 phase Salient Pole Alternator coupled to DC integrated motor setup (Motor-Generator setup) Trainer** **Features :** • Should have 4mm sturdy shrouded banana patch cords & shrouded arrangements. • All machines should be mounted on finely painted sturdy base frame with easy machine Interchange ability. • Should be able to draw all graphs • Machines should operate upto 300W power levels & upto 1500 RPM. • Must use Trunnion mounted DC machine as Dynamometer for loading other machines with facility to measure shaft power using electronic torque / speed measurement	**1**	**0**	**1**	**1**	**0**	**1**	**0**	**0**	**0**	**4**	

	• One Dynamometer type DC m/c per Aluminum Rack with multiple panels **A) Technical Specifications of interfacing panel rack - 1 No.** Powder coated Sturdy aluminums Flat panel system made up of Alluminium extruded profiles carrying various high voltage components housed in plastic enclosures to minimize shock possibility. Should be able to hold following control panels with colorful overlay. • **Trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there & shrouded 4 mm banana patch cords & shrouded sockets arrangements for the safety of the students** **B) Each control panel rack consists of : -** **Input 3 phase DOL Starter panel** [10 Shrouded Banana] **1 No.** •4 pole MCB of 415 V/4A. •DOL 9A Contactor with 230V / 50 Hz / 11VA COIL. •Bimetallic thermal O/L relay with range 1.4A - 2.3A. **Integrated AC (1 phase) measurement panel 1 No.** . •Bidirectional Multifunction Meter •3 Phase 3/4 wire, 415V, CT Input 5A •LCD/LED display, Aux supply 230V, 45-65 Hz, 5W •V.I., Hz, Pf, KVA, KW, KWH Modbus RTU RS 485 **3 Ph. Bidirectional power cum Energy meter panel --1 No.** • Bidirectional Multifunction • 3 Phase ¾ wire, 415V, CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V,I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485												

	FWD/REV, Star-Delta starter panel --1 No. • FWD/REV, 3 pole 3 way switch with centre OFF, 6A/440V. • Star/Delta switch 3 pole, 3 way with centre OFF, 6A/440V. **3 Phase wound Rotor & Sync. Motor panel --1 No.** • Rotor resistors of 30E/5A with 3 taps of 15E, 21E, 30E each - 3 Nos. • Rotor resistor selector switch, 3 pole. 6 Way 6A/440 V. • DC Rotor excitation with circuit breaker (3Amp) • 1 ph. Motor, Alternator & Sync. Motor Panel • 1 ph. MCBs of 4A/1.6A 1 each. • 2 no. 2P2W selector switches to run as 1ph. alternator then as synchronous motor. • 8A pushbutton switch to simulate as centrifugal switch. • 1 No. lamp holder with input sockets **DC voltmeter & DC ammeter panel 1 No.** a) DC voltmeter(0-300V) b) DC Ammeter (0-5A) with polarity protection diode c) Field failure relay to control Armature supply. d) 4A Circuit Breaker. • **SCR Actuator (variable DC) cum sensor signal conditioning panel** **--3 Nos** • Full bridge SCR based 0V-195V / 3 Amp cosine firing with linear characteristics. • Supports signal conditioning circuit for speed, torque in kg. to give output 0-2.5Vdc (FS). 3 Nos. of these supplies required for DC Armature, DC motor field & AC generator field. • Provided with built in P/PI controller to keep DC motor (prime mover) speed constant while synchronizing 3 coupled 3 phase alternator with grid / other 3 phase alternator. **Instrumentation Power supply cum Multichannel DPM panel 1 No.** (a) +/-12 V, 500 mA (b) +5V, 300mA (c) Unregulated 17V												

	dc/750 mA (d) line synchronizing signal. (e) Multi channel DPM for digital display of torque, speed etc **Resistor Load Panel 1 No.** Should have off position to run on no load. (1)**AC Resistors** = 10K/200WX3 phases/ 6 steps (2) **DC Resistors** = 750E/400W / 6 steps **LC Load panel 1 No.** (A) Inductive load = 0.15H/0.3H/0.45H/0.6H/0.75H/1.5H/3H/400mAX3Nos. (B) Capacitive load =1.25µ/2.5µ/5µ/415VX 3Nos. **Variable AC & DC Supply Panel** Variable O/P : AC 0-270V/3A Variable O/P : DC 0-250V/3A **Following Essential accessories should be provided with trainer:** A) Hand held tacho meter – 1 No. B) Shrouded patch chord – 118 C) Well written students workbook explaining at least 50 experiments with instructor guide. – 1 No. D) Demo CD to help student to work by themselves – 1 No. **A. PC interface needs following additional panels:** **1) AC Multi parameter measurement meter (MMM)/Power Network analyzer** • These MMM meters replace above since they offer modbus connectivity. • Modbus RS485 to USB converter needed – 2nos. **2) DC Current /Voltage Measurement Expt. Panel** • DC current hall sensor (x2nos.): Closed Loop current measurement using Hall sensor IC (max. I/P upto 20A, 50/60Hz), Isolation = 2.1KV, Proportional O/P = 0 - 2.5V,												

	1 CH. • DC Voltage transducer (x2 nos): Using high speed opto coupler IC (max. up to 600Vdc), isolation = 2 KV, 1 CH. • Function Blocks Used : Precision rectifier (x 2 nos) with gain = 5, LPF (x2nos) with gain = 2, Span Zero Circuit to interface with ADC(0-2.5Vdc) for both current & voltage, only 1 functional block each supplied, 2nd , Field failure/zero current detector. Needs CIP panel to interface with PC USB port. **3) Computer Interface panel**• Connects to PC USB port using USB IO module through 25 pin D (M) connector on CIP & type A to mini B cable. • 4 ADC channels I/P: 0 to 2.5V FS with 1no input simulation pot. 1 DAC channel O/P 2.5V FS. • V to I function block: I/P 0 to 2.5V & O/P 0-20 or 4-20mA (100E load) switch settable. • I to V function block : I/P 4 to 20mA & O/P 0 - 2.5V **4) Software on CD:** • Virtual Workbench package is a USB / serial modbus based software working on windows dot Net platform coupled with USB IO module useful as general purpose utility which supports different control strategies like Single or multi loop PID controllers, Fuzzy controller etc, Graph plotting in XY, XT & polar mode etc, Modbus interface, Data logging, Event trigger, inbuilt Function generator etc **a. DC Integrated machine 1 No.** Voltage : Varm = 180V, Vfield = 180V Capacity/RP M/Terminals : 300W / 2 Pole m/c / 1500RPM 6 terminals Rotor Construction : Should be Standard commutator / brush arrangement with laminated stack, brought out on												

	2 terminals Stator Construction : separately excited field winding with laminated pole solid yoke & series winding brought out on 4 terminals Chasis mounted, 19mm dia, trunion mounted Machine for use as Dynamometer with torque & speed sensors. Must be able to work as shunt/series/compound motor as well as generator. **b. Salient Pole alternators: - 3 Phase - 1No.** **Voltage:** 415VAC, 50Hz **Capacity/RPM /Terminals** : 300W/4 Pole m/c / 1500RPM **Rotor Construction:** Star connected, four terminals including star point brought out on 4 slip rings mounted on shaft. **Stator construction** : Separately excited field winding with laminated solid yoke, 4 pole brought out on 2 terminals **Winding Temp. :** A embedded Thermistor brought out on 2 eyelets mounted on terminal box for monitoring winding temperature **Frame/ Mounting Shaft dia:** 90 Frame, Chasis mounted 19mm dia. With easily swappable gear coupling **Net Weight / Gross Weight:** 35Kg, 54Kg **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**												

46.	**AC Servo Motor Trainer with PID Controller** **SALIENT FEATURES** Learn how an Analog as well as Digital PID works. Facility to monitor behaviour of the controller output (Un) & process variable (MV) either on PC screen or on CRO. Settable time constants. P4/XP or latest version window based PID controller (DDC) software package with P, PI & PID control, Ratio & cascade control, three operating modes, Online graph drawing & data acquisition modes (SCADA). PC not in scope of supply Can learn about different processes using simulated building blocks as well as real life processes using replaceable experiment panels/processes & built in square / triangle / sin function generator as disturbance. Graph printing facility for laboratory journal entries. Aesthetically designed injection molded electronic desk (master unit) carrying useful experiment resources like Power supplies, DPMs, Computer Interface, Analog PID controller with central slot to hold various replaceable experiment panels / processes. Connection through sturdy 4mm Banana sockets & Patch cords, Students workbook & Instructor's Guide provided. Useful for Post Graduate projects & research purpose. **Basic Resources on Top board** **Built in power supply** DC supply +12V,500mA. 1phase sine reference for cosine firing 30Vpp max. 17Vdc, 500mA unregulated for driving pulse X'mer	2	1	0	1	1	1	1	0	0	7	

	Variable DC power supply : 7 to 14V/3A **Display** A) DPM - 2Nos. i) For Temp. upto 1000C & intensity in Lux (2000) ii) For speed 2000 rpm & voltage upto 20V. B) Analog Meter - 2Nos. i) Centre zero for display of process error (+9V) ii) For MV/SP (0-2.5V) **Operating voltage** Switch selectable 220-240Vac, ±10%, 50Hz, 75VA **PC (WIN7/8/10) based PID controller** **Online monitoring / Data acquisition / PID Software** : on Installable (CD) works under XP, WIN7/8/10 PC with parallel port / USB needed. **Operating modes** **a) Simulator Mode** Tests data already stored in files (*.txt) & Drawing graph for all P,PI,PD & PID modes. **b) Process Monitoring Mode** Drawing graphs of analog data presented at CH 0 & CH of Computer Interface. Cursors for X & Y axis for measurement & online graphs savings for reproduction **c) PID controller Mode** PID controller with parameters like Integral Time Ti (0.01-64000), Sampling Time Ts (0.1- 99.9), Derivative Time Td (0.1-99.9), Proportional Band Pb(1-999), Derivative Gain Kd(1-999), Set Value Rn (0- 99.9), PID output Upper Limit Uh(0-99.9), PID output Lower Limit Ul (0- 99.9). Facility to set units for output viz. Percentage (%), oC, RPM, Voltage(V), mm, LPH, kg/cm2, si/cm, degree.												

	⍰ Supports experiments with advance process control scheme viz; Ratio, Cascade, feed forward with user selectable Aux PID, Ratio station & programmable FF transfer function calculator, selective & split control strategies, Multi DPM Screen. ⍰ **Computer Interface Adapter** ⍰ Optoisolated Adaptor to prevent damage to PC parallel port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. PC/WINXP/7/8/10 not in scope of supply. 4 ADC channels : 0 to 2.5V full scale. 1 DAC channel : O/P 2.5 V FS. V to I Function block : Input : 0-2.5Vdc O/p: 0-20 or 4-20mA, in 100E load Max ⍰ USB IO module to interface 25 pin D connector on CIA panel to USB PC port enclosed in 25 Pin D shell using Type A to mini B cable. ⍰ V to PWM function block : I/P -0-2.5V, O/P-1KHz PWM O/P ±9V. **Analog PID (APID) controller** with built in low freq. function generator ⍰ **Controller selection P,PI,PD,PID with slide switch** **Parameter settings :** Integral Time Ti (0.5-25Sec) : Derivative Time Td (0-2Sec) : Proportional Band Pb (5- 200%) : Set point (-9V- +9V) ⍰ **Operating modes:** Fast (X 100/10mSec) for oscilloscope, Slow (X 0.1/1Sec) for PC interface. ⍰ 2 No. Level shifter converting process O/p (+9V) to 0-2.5V for PC interface & Actuator panel ⍰ Test points for Process Error, Set Point (Rn), Measured Value (Cn), Controller output (Un).												

	Built in function generator O/p waveform selectable sine, triangular & square. O/p freq. range from 0.016Hz to 166Hz, 4 steps & fine control pot. Variable amplitude control 0 to +9V. **Servo Interface panel** Control Interface circuit for AC & DC servo motor, signal conditioning circuit for speed sensor to output 0 - 2.5V dc (2500RPM) with speed direction. Level shifter 0 - 2.5V to ± 9V (2nos). Hystersis, Dead band & Relay control circuit (2term & 3 term), process block for 2Nos. of 1st order lag / integral + transport lag, error & gain block for process simulation. Should have following real life process **ii) AC servo position control** AC geared (50:1) servo motor. Main winding 230VAC, control winding 6VAC/3A O/P shaft RPM 25 (D), ND RPM 2500. Loading: Using PMDC motor 12VDC, 40W, 2000RPM. Servo amplifier with built in 12V/3A Power Supply. Sensor: Servo pot as position feedback for position control. **List of Experiments** PID tunning by Ziegler Nichols Motor Process parameter study torque speed Dynamics measurements & transfer function determination. Close loop position control using 2/3 step controller. Close loop using 2/3 step controller with simulated processes. Position control of AC motor Open loop Response & determination transfer function.												

	⍰ Set Point Position Control of AC Motor **Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students STC).**											
47.	**DC Servo Position control Trainer with PID controller** **SALIENT FEATURES** ⍰ Learn how an Analog as well as Digital PID works. ⍰ Facility to monitor behaviour of the controller output (Un) & process variable (MV) either on PC screen or on CRO. Settable time constants. ⍰ P4/XP or latest version window based PID controller (DDC) software package with P, PI & PID control, Ratio & cascade control, three operating modes, Online graph drawing & data acquisition modes (SCADA). PC not in scope of supply ⍰ Can learn about different processes using simulated building blocks as well as real life processes using replaceable experiment panels/processes & built in square / triangle / sin function generator as disturbance. ⍰ Graph printing facility for laboratory journal entries. ⍰ Aesthetically designed injection molded electronic desk (master unit) carrying useful experiment resources like Power supplies, DPMs, Computer Interface, Analog PID controller with central slot to hold various replaceable experiment panels / processes. ⍰ Connection through sturdy 4mm Banana sockets &	0	1	0	0	0	1	1	1	0	4	

	Patch cords, Students workbook & Instructor's Guide provided. Useful for Post Graduate projects & research purpose. **Basic Resources on Top board** **Built in power supply** DC supply +12V, 500mA. 1phase sine reference for cosine firing 30Vpp max. 17Vdc, 500mA unregulated for driving pulse X'mer Variable DC power supply : 7 to 14V/3A **Display** A) DPM - 2Nos. i) For Temp. upto 1000C & intensity in Lux (2000) ii) For speed 2000 rpm & voltage upto 20V. B) Analog Meter - 2Nos. i) Centre zero for display of process error (+9V) ii) For MV/SP (0-2.5V) **Operating voltage** Switch selectable 220-240Vac, ±10%, 50Hz, 75VA **PC (WIN7/8/10) based PID controller** **Online monitoring / Data acquisition / PID Software** : on Installable (CD) works under XP, WIN7/8/10 PC with parallel port / USB needed. **Operating modes** **a) Simulator Mode** Tests data already stored in files (*.txt) & Drawing graph for all P,PI,PD & PID modes. **b) Process Monitoring Mode** Drawing graphs of analog data presented at CH 0 & CH of Computer Interface. Cursors for X & Y axis for measurement & online graphs savings for reproduction **c) PID controller Mode**												

	PID controller with parameters like Integral Time Ti (0.01-64000), Sampling Time Ts (0.1- 99.9), Derivative Time Td (0.1-99.9), Proportional Band Pb(1-999), Derivative Gain Kd(1-999), Set Value Rn (0- 99.9), PID output Upper Limit Uh(0-99.9), PID output Lower Limit Ul (0- 99.9). Facility to set units for output viz. Percentage (%), oC, RPM, Voltage(V), mm, LPH, kg/cm2, si/cm, degree. Supports experiments with advance process control scheme viz; Ratio, Cascade, feed forward with user selectable Aux PID, Ratio station & programmable FF transfer function calculator, selective & split control strategies, Multi DPM Screen. **Computer Interface Adapter** Optoisolated Adaptor to prevent damage to PC parallel port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. PC/WINXP/7/8/10 not in scope of supply. 4 ADC channels : 0 to 2.5V full scale. 1 DAC channel : O/P 2.5 V FS. V to I Function block : Input : 0-2.5Vdc O/p: 0-20 or 4-20mA, in 100E load Max USB IO module to interface 25 pin D connector on CIA panel to USB PC port enclosed in 25 Pin D shell using Type A to mini B cable. V to PWM function block : I/P -0-2.5V, O/P-1KHz PWM O/P ±9V. **Analog PID (APID) controller** with built in low freq. function generator **Controller selection P,PI,PD,PID with slide switch** **Parameter settings :** Integral Time Ti (0.5-25Sec) : Derivative Time Td (0-2Sec)												

	: Proportional Band Pb (5- 200%) : Set point (-9V- +9V) **Operating modes:** Fast (X 100/10mSec) for oscilloscope, Slow (X 0.1/1Sec) for PC interface. 2 No. Level shifter converting process O/p (+9V) to 0-2.5V for PC interface & Actuator panel Test points for Process Error, Set Point (Rn), Measured Value (Cn), Controller output (Un). **Built in function generator** O/p waveform selectable sine, triangular & square. O/p freq. range from 0.016Hz to 166Hz, 4 steps & fine control pot. Variable amplitude control 0 to +9V. **Servo Interface panel** Control Interface circuit for AC & DC servo motor, signal conditioning circuit for speed sensor to output 0 - 2.5V dc (2500RPM) with speed direction. Level shifter 0 - 2.5V to ± 9V (2nos). Hystersis, Dead band & Relay control circuit (2term & 3 term), process block for 2Nos. of 1st order lag / integral + transport lag, error & gain block for process simulation. Should have following real life process **i) DC servo position Control** PMDC motor 12Vdc, 40W, ND RPM 2000RPM with gear box (Ratio 30:1) Loading:. Servo amplifier with built in 12V / 3A Power Supply. Sensor: Photo reflective speed sensor with dir detects using 2 nos. of photodiodes. Servo pot as position feedback, position, speed, cascade control.												

	List of Experiments ⍰ PID tunning by Ziegler Nichols Motor Process parameter study torque speed Dynamics measurements & transfer function determination. ⍰ Close loop position control using 2/3 step controller. ⍰ Close loop using 2/3 step controller with simulated processes. ⍰ Open loop speed control of DC servo motor process III. ⍰ Speed/Velocity control of DC motor ⍰ Close loop control with analog pid ⍰ Close loop control with digital PID ⍰ Position control of DC motor ⍰ Cascade control of speed & position feedback **Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students STC).**												
48.	**Measurement of linear displacement by LVDT Transduser trainer** **The Trainer set should consist of the following features:** **SALIENT FEATURES** • Aesthetically designed injection moulded electronic desk. Master unit carrying useful experiment resources like Power supplies, DPMs, Bar graph LED indicator Function Generator etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure.	**2**	**0**	**0**	**2**	**0**	**0**	**1**	**1**	**0**	**6**		

	• Has colorful screw less overlay showing schematic & its connection tag numbers for easy connectivity. Transparent acrylic overlays will be offered for all sensors **Master Unit** • **Built in power supply :** DC supply +/- 12V, 500mA, Variable 7V to 14V @ 3Amp. • **Built in function generator** • **O/P waveform** sine, triangular & square, TTL O/P freq. 1Hz to 200KHz in ranges with amplitude & freq. control pots, o/p voltage 10Vpp. • **On board measurement :** DC voltmeter 2V/20V (1 No) & LED BAR graph with 10 LED indicator to display 0-2.5V or 0-4V input. **Displacement Sensing Transducers:** •**Micrometer** 0-20mm (Accuracy 0.01mm) • Precision phase sensitive rectifier • Measurement frequency of 1KHz sine • Signal conditioning circuit with zero & span adjustment for calibration of variac sensor output voltage 0-2.5V or suitable for DPM. • **Zero & span adjustment for calibration of following transducers** i) Resistive linear transducer : 0 -20mm ii) Capacitive linear transducer : 0 -20mm iii) Capacitive angular transducer : 0 - 90 degree iv) Inductive linear transducer : 0 -20mm v) LVDT transducer : 0 -20mm or (-10 to +10mm)												

	Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students STC).											
49.	**Strain gauge Transduser trainer** **The Trainer set should consist of the following features:** **SALIENT FEATURES** • Aesthetically designed injection moulded electronic desk. Master unit carrying useful experiment resources like Power supplies, DPMs, Bar graph LED indicator Function Generator etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure. • Has colorful screw less overlay showing schematic & its connection tag numbers for easy connectivity. Transparent acrylic overlays will be offered for all sensors **Master Unit** **• Built in power supply :** DC supply +/- 12V, 500mA, Variable 7V to 14V @ 3Amp. **• Built in function generator** **• O/P waveform** sine, triangular & square, TTL O/P freq. 1Hz to 200KHz in ranges with amplitude & freq. control pots, o/p voltage 10Vpp. **• On board measurement :**	**2**	**0**	**0**	**2**	**0**	**1**	**1**	**1**	**0**	**7**	

	DC voltmeter 2V/20V (1 No) & LED BAR graph with 10 LED indicator to display 0-2.5V or 0-4V input. **Strain Gauge Transducers** • Piezo resistive transducer for strain measurement. • Micrometer 0-20mm (Accuracy 0.01mm) for strain generation. •Strain gauges mounted on cantilever in half & full Wheatstone bridge & instrumentation amplifier with Zero & span adjustment for calibration. •Experiments on Gauge factor determination, Strain indicator, Displacement measurement using Strain gauges. **Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students STC).**											
50.	**Temperature sensing Transduser trainer** **The Trainer set should consist of the following features:** **SALIENT FEATURES** • Aesthetically designed injection moulded electronic desk. Master unit carrying useful experiment resources like Power supplies, DPMs, Computer Interface, Bar graph LED indicator Function Generator etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure. • Has colorful screw less overlay showing schematic & its	**2**	**0**	**0**	**2**	**0**	**0**	**1**	**0**	**0**	**5**	

	connection tag numbers for easy connectivity. Transparent acrylic overlays will be offered for all sensors **Master Unit** • **Built in power supply :** DC supply +/- 12V,500mA, Variable 7V to 14V @ 3Amp. • **Built in function generator** • **O/P waveform** sine, triangular & square, TTL O/P freq. 1Hz to 200KHz in ranges with amplitude & freq. control pots, o/p voltage 10Vpp. • **On board measurement :** DC voltmeter 2V/20V (1 No) & LED BAR graph with 10 LED indicator to display 0-2.5V or 0-4V input. • **Computer interface** Interfaces through 25 pin parallel port [LPT port] optoisolated adaptor to prevent damage to PC parallel port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. /WIN7/8/10 not in scope of supply. Lab View based executable to support virtual instrumentation with drivers supplied. • 4 ADC channels : 0 to 2.5V full scale • 1 DAC channel : o/p 2.5 V/12 V switch selectable full scale • V to I Function block: Input: 0-2.5Vdc, Output: 0-20 or 4-20mA, upto max. 2Vdc GND compliance • V to PWM function block: I/P -0-2.5V, O/P-1KHz PWM O/P +9V. • USB IO module (HID class) to interface 25 pin D													

	connector on CIA panel to USB PC port enclosed in 25 pin D shell using Type A to mini B cable. **Temperature Sensing Transducers** • Instrumentation Amplifier to amplify thermocouple signals • Built in heat bar / mini oven driven by Power Amplifier of sufficient wattage • Temp. Selection upto 95 degree C in 5 ranges with ON / OFF closed loop control. **Temp. sensors:** i) Thermocouple J with room temp. calibration pot. ii) Thermocouple K with room temp. calibration pot. iii) Thermister (100K), iv) PT100, v) IC sensor (AD 590) vi) Bimetallic switch **Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students STC).**												
51.	**Pressure measurement by Piezo resistive transducer trainer** **The Trainer set should consist of the following features:** **SALIENT FEATURES** • Aesthetically designed injection moulded electronic	**2**	**0**	**3**	**2**	**1**	**1**	**1**	**0**	**0**	**10**		

	desk. Master unit carrying useful experiment resources like Power supplies, DPMs, Bar graph LED indicator Function Generator etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure. • Has colorful screw less overlay showing schematic & its connection tag numbers for easy connectivity. Transparent acrylic overlays will be offered for all sensors **Master Unit** **• Built in power supply :** DC supply +/- 12V, 500mA, Variable 7V to 14V @ 3Amp. **• Built in function generator** **• O/P waveform** sine, triangular & square, TTL O/P freq. 1Hz to 200KHz in ranges with amplitude & freq. control pots, o/p voltage 10Vpp. **• On board measurement :** DC voltmeter 2V/20V (1 No) & LED BAR graph with 10 LED indicator to display 0-2.5V or 0-4V input. **Piezo resistive transducer for pressure measurement (0-15psi)** • Pressure sensor 0- 15 psi (20 psi max.), gage type, Pressure generating hand pump connected using T connector to the sensor & Bourden pressure gauge for measurement & calibration. **Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection**												

	molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students STC).											
52.	**Angular Speed measurement using stroboscope & tacho meter Transduser trainer** **The Trainer set should consist of the following features:** **SALIENT FEATURES** • Aesthetically designed injection moulded electronic desk. Master unit carrying useful experiment resources like Power supplies, DPMs, Computer Interface, Bar graph LED indicator Function Generator etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure. • Has colorful screw less overlay showing schematic & its connection tag numbers for easy connectivity. Transparent acrylic overlays will be offered for all sensors **Master Unit** **• Built in power supply :** DC supply +/- 12V, 500mA, Variable 7V to 14V @ 3Amp. **• Built in function generator** **• O/P waveform** sine, triangular & square, TTL O/P freq. 1Hz to 200KHz in ranges with amplitude & freq. control pots, o/p voltage 10Vpp. **• On board measurement :**	2	0	0	2	1	1	1	0	0	7	

	DC voltmeter 2V/20V (1 No) & LED BAR graph with 10 LED indicator to display 0-2.5V or 0-4V input. **• Computer interface** Interfaces through 25 pin parallel port [LPT port] optoisolated adaptor to prevent damage to PC parallel port (25 pin LPT) due to wrong connections. Interfaces through 25 pin M to F cable 1mtr Length. /WIN7/8/10 not in scope of supply. Lab View based executable to support virtual instrumentation with drivers supplied. • 4 ADC channels : 0 to 2.5V full scale • 1 DAC channel : o/p 2.5 V/12 V switch selectable full scale • V to I Function block: Input: 0-2.5Vdc, Output: 0-20 or 4-20mA, upto max. 2Vdc GND compliance • V to PWM function block: I/P -0-2.5V, O/P-1KHz PWM O/P +9V. • USB IO module (HID class) to interface 25 pin D connector on CIA panel to USB PC port enclosed in 25 pin D shell using Type A to mini B cable. **Speed sensing transducers:** • 12V DC motor with speed varying from 0-4000rpm & rotating slotted wheel having 8 slots • Individual signal conditioning circuit with programmable threshold comparator. • F to V Converter with span & zero amplifier • 6 Nos. of Speed transducers & their experiments: 1) Magnetic pickup, 2) Photo reflective, 3) Photo interruptive												

	4) Inductive pickup with 5) Stroboscope envelop detector. 6) Hall sensor. **Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students STC).**											
53.	**OP-AMP Trainer** **SALIENT FEATURES** • Aesthetically designed injection molded electronic desk (Main unit) carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure, & has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Set of Users Guide provided with each Unit. **SPECIFICATIONS OF MAIN UNIT** **•Built in Power Supply :** DC Supply: 5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA (Isolated High Volt DC 15V to 110V, 100Ma, AC Supply : 12-0-12V AC,150 mA. Short circuit Protected. **•Built in Function Generator –** O/p Waveform : Sine, Triangle & TTL O/Ps	**2**	**0**	**0**	**2**	**1**	**2**	**0**	**1**	**0**	**8**	

	Output Frequency: 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) •**Clock Generator:** 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, for High / Low indication. •**Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt : 2V/200V - 1No. (B) DC current: 2mA/200mA - 1No. (C) DC Volts/Current: 20V/200mA - 1No. •**Onboard moving iron meters provided for** (A) AC Current: 1 AMP - 1No. (B) AC Voltage: 15V - 1No. •Onboard speaker: 8 Ohms, 0.5 Watt (1No.) •Onboard POTS: 1K - 1No. 1M - 1No. •Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA. **Operational Amplifier Circuit Experiment panel :** Inverting amplifier, Non-inverting amplifier, Summing amplifier, Difference amplifier, Integrater circuit,												

	Differentiator circuit, Precession rectifier: Half wave & full wave, Voltage to current converter, Current to voltage converter, Op-amplifier characteristics, Instrumentation amplifier, Schmitt trigger, Comparator, Sign Changer, Offset Null, Peak detector, Clipping circuit, Clamping circuits (DC restorer), Waveform Generator. **Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students STC).**											
54.	**ADC & DAC Circuits Trainer** **SALIENT FEATURES** • Aesthetically designed injection molded electronic desk (Main unit) carrying useful experiment resources Variable Power supplies / Status / Pulsar / Function Generator, DPMs etc. while the central slot will carry replaceable experiment panel secured in an ABS molded plastic sturdy enclosure, & has colorful screw less overlay showing circuit & its connection tag numbers for easy connectivity. • Connection through Sturdy 4mm Banana Sockets & Patch Cords. •Set of Users Guide provided with each Unit. **SPECIFICATIONS OF MAIN UNIT** **•Built in Power Supply :** DC Supply: 5V / 1A. & ± 12V, 1A. 0 to 15V DC (Variable), 100 mA (Isolated), 0 to 30V DC (Variable), 100 mA (Isolated High Volt DC 15V to 110V, 100Ma, AC Supply:	2	0	0	2	1	1	0	1	0	7	

	12-0-12V AC, 150 mA. Short circuit Protected. **•Built in Function Generator –** O/p Waveform : Sine, Triangle & TTL O/Ps Output Frequency: 1 Hz to 1MHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20Vp-p max. (Sin/TRG), Modulation I/P:AM : - I/P voltage + 5V (100% modulation) O/P - For 0V (min), + 5V (max.) - 5V (Phase reversal of O/P) FM : I/P voltage ± 400mV (+ 50% modulation) **•Clock Generator:** 10 MHz TTL clock. •Data Switches (10 No.) & bi-colour LED status indicators 10X2 Nos, for High / Low indication. **•Pulser switches** (2 Nos.) with four debounced outputs - 2No. •BNC to 2 channel banana adapter - 2No. •Logic probe to detect High/Low level pulses upto 1MHz, with bi-colour LEDs to indicate status. •2 / 4 digit 7 segment display with BCD to 7 segment decoder. •Onboard DPMs provided with mode/range selection. (A) DC volt: 2V/200V - 1No. (B) DC current: 2mA/200mA - 1No. (C) DC Volts/Current: 20V/200mA - 1No. **•Onboard moving iron meters provided for** (A) AC Current: 1 AMP - 1No. (B) AC Voltage: 15V - 1No. •Onboard speaker: 8 Ohms, 0.5 Watt (1No.) •Onboard POTS: 1K - 1No. 1M - 1No. •Operating Voltage: 220/240Vac switch settable ±10%, 50Hz/60VA.												

	ADC & DAC Circuits Experiment Panel : 8 bit ADC, 0-5V I/P:- Dual slope ADC, Tracking ADC, SAR ADC, RAMP ADC, Bipolar ADC using level translator, Delta Sigma ADC , 8 bit DAC:- O/P Range 0 5V & +/-5V. **Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students STC).**											
55.	**PELTON TURBINE TRAINER (Assemble & dismantle of micro hydro plant)** **Salient Features** • Use of UPVC piping in line with current industrial practice • Aluminum profile HB with lockable caster wheels allow the user to move the bench around the lab and have foot operated locks to hold the bench in position. **Technical Specification** **DC voltmeter & DC ammeter panel** •DC voltmeter 0-300VDC, DC ammeter 0-5A/10A, 4A/10A circuit breaker Single phase supply panel - 1 No. • Single phase MCBs of 20A/ 4A **IGBT controlled AC motor VVVF drive panel** □ Input voltage: 230VAC, 50Hz, • Output voltage: 3 phase 200 to 230VAC □ Range (frequency control): 1Hz to 100Hz □ Control mode: Sine wave PWM □ Capacity: 2HP with reverse and forward direction	1	0	1	0	1	1	1	0	0	5	

	3 phase bidirectional cum energy meter panel • Bidirectional multifunction • 3 phase 3/4 wire, 415VAC, CT input 20A • LED/LCD display, Aux. supply 230V, 45-65Hz, 5W • Measure V,I,Hz,Pf,KVA,KW,KWH210223 **1 ph. Motor, Alternator & Sync. Motor Panel** 1 ph. MCBs of 4A/1.6A 1 each. 2 no. 2P2W selector switches to run as 1ph. Alternator then as synchronous motor. 8A pushbuttons switch to simulate as centrifugal switch. 1 No. lamp holder with input sockets **Fluid apparatus:** **Water delivery& storage** HB: 2HP mono block pump with 1ϕ I/P to 3ϕ O/P VFD drive, Pump: Star 440Vac/ Delta230Vac, 1.5Kw, 2800RPM, Head:25m, Flow:11160 LPH, Inlet: 2"(50mm), Outlet:1.5" (37.5mm) / 8000LPH rotameter to measure flow **Setup: Experiment components** Piping: UPVC (1.5"), Elbow: UPVC (1.5"x 2nos), Union: UPVC (1.5"), Acrylic enclosure with buckets mounted on brass hub & brake pulley loading **Control panel rack** 4x2 Aluminum profile (45x45) rack to mount resource panels												

Table top panel
Aluminum cast buckets (18nos) mounted on Periphery of rotating brass hub, Brake pulley loading: 10Kg x 2nos or 1HP BLDC generator optional, 10mm brass nozzle to impact water on buckets

Mechanical sensors
On HB: Oil filled, 0-8 Bar, 2.5" dial size, 1/4" port pressure gauge

List of experiments
1) To study char. of Pelton turbine and calculate its efficiency using brake pulley spring loading arrangement
2) To study char. of Pelton turbine and calculate its efficiency using BLDC generator

Technical Specification
Trolley with caster wheel : 1200x450x700mm
Sump tank : 134L with water level indicator
Centrifugal Pump mono-Block: Inlet: 2"(50mm), Outlet:1." (37.5mm)
Pressure gauge : 10 bar
Flow measurement : 8000 LPH Rotameter
Plastic filter : 1.5 inch (37mm)
Nozzle : 1.5 inch (37mm)
Drain valve : 1 inch (25mm) drain valve with cap
Water level indicator: 6x4mm transparent pipe
Bypass & flow control valve: 1.5 inch (37.5mm)
Piping : UPVC, 1.5 inch (37.5mm)
Flexible pipe: 1.5" Reinforce flexible pipe

Electrical specifications

	Centrifugal Pump mono block : 3Phase, Star 440Vac/ Delta230Vac, 2HP, 1.5Kw, 2800RPM, Head:25m, Flow:11160 LPH **Motor display panel :** 6 nos. SBS5 sockets for 415Vac star & 230V delta for VFD drive located in control panel of rack **Motor drive:** 2HP 1phase operated VFD drive for Pelton **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
56.	**MICROCONTROLLER TRAINER 8051** **SALIENT FEATURES** • Ergonomically injection molded Plastic enclosure. • Use of standard PC 101/PS2 Keyboard for programming. • Emphasis on Hardware troubleshooting through on board short links. • Exhaustive Didactic Courseware. • Critical & delicate ICs are protected under acrylic cover from below. •All in one Logical IO® Monitor design Supports both serial IO & Keyboard display console IO. **Technical Specifications:**	**2**	**0**	**0**	**1**	**1**	**0**	**2**	**1**	**0**	**7**	

	8051 **MEMORY CAPA.:** Monitor : EPROM: 36KB, Battery Back Up : 16KB(64 KB) Scratch Pad: 2KB(8KB) **ADVANCED S/W: [**Assembler:/ Disassemble] • 1 Pass • Disassembler • Hex Dump **Additional serial no. & parallel I/O:** • Using built in TxD/RxD • Unused pins of P1 port offered through 10 pin reliamate **INTERRUPTS:** • 8 Nos.Using • 8259A **•User Manual :** 1) Student Workbook 2) Instructor Guide & Technical Reference 3) Lab Exercise Book for 86. **•Speed** 20 MHz crystal operated multi-output clock source to operate various resources on Mother Board like CPU, Baud rate, T/C etc. **•Parallel I/O** 48 I/O lines using two 8255 through 2 Nos. of 26 pin FRC header, printer I/F. **•Serial I/O**											

	RS-232c serial interface using 8251 & RS232 driver IC through 9 Pin male D connector. **•Timer counter** 3 Nos. T/C using 8253 pins brought out on 6 pin reliamate. **Display(Choose one option) :** • 16 X 2 LCD (Backlit) **•Key Board :** Single chip micro- controller 89C2051 to support 101Keys PC AT / PS2 Keyboard & LCD **•System Bus** 50 Pin FRC buffered Bus to connect periware cards as well as to facilitate ROM Emulation of 8 bit/16 bit system memory using external ROM emulation card cum converter card. **•Battery Backup** Rechargeable NiCd battery (3.6/60maH) provided to supply power to battery backup memory & RTC 58167. **Onboard Features** •External Loud Speaker (8ohm/0.5W) interface for experiments on frequency synthesis. •Reset & Single Step/Interrupt push button. •EP socket for experiments with Cassette recorder interface. •Programmable Wait state generator l Real Time Clock IC 58167 •11 Nos. fault links to teach troubleshooting skills by												

	introducing faults in the circuit. •PALs-All glue logic like Memory I/O decoders are implemented using 4(5) nos. of EEPROM PALs 16V8 **Power Supply (SMPS)** I] Select one of 2 options I) 5V /2.5 Amp SMPS with RCA plug. II] 5V /2.5 Amp SMPS with RCA plug +12 V/ 850 mA , -12V/250 mA with 4 pin reliamate SMPS. **Cables & CD :** 9 Pin Female to 9 Pin Female RS-232c Cable, 26 Pin FRC IO Cable, Centronics Interface cable (26 pin FRC to 36 pin Centronics female), USB to RS232 Cable, Sample program & Software on CD . **Fault Links:** • Shorts 2 Pins of Address Bus. • Shorts 2 Pins of Data Bus. • Shorts Address pin to Data Bus. • Increasing Battery Discharge. • Disables RD/ & WR/ into BBK RAM • Permanent Wait State. • Disables 7 Segment Scanning. • Disables 7 Segment Data. • Permanent Reset State. • Stops 20MHz Clock. •Disables Baud Rate Clock. **AD-DA-I** Temperature Controller with MINI OVEN with 8 bit ADC-8 bit DAC cum Instrumentation Opamp study card. **AD-DA-II**												

	8 bit 8 channel ADC & 8 bit DAC (0-5V), Digital gain amplifier with built in L/S interface Electrets micro-phone with preamplifier, light sensor, analog bar graph, voice sampling & replay. **SCAN TECH** Scanning Techniques illustrating 8X8 LED Matrix, 4X4 Keypad 7 segment 8 digit red LED display study card. : 1.Opto Relay 2.GLCD **STDC MOTOR** Stepper motor & 12V DC Motor Interface card with motors mounted to illustrate speed, direction control. 1) RPM measurement. 2) LM35 temperature Sensor 0-12V) **TLLC+ Elevator** Traffic light of 2 intersections cum logic study card with 24 tags & 24 LED's. following - Elevator SAP consisting of 3 floors, Floor request keys, child protection lock, Opto-coupler, Relay, Buzzer. **Inclusive of 2 Year of onsite warranty and trainer should be safety aesthetically designed injection molded desk not wooden box (anti Green), not metallic box (Corrosive and shock possibility for the students STC).**											
57.	**SOLAR AND WIND TURBINE TRAINER** **Solar Technology Trainer** **SALIENT FEATURES**	**1**	**0**	**1**	**0**	**1**	**0**	**0**	**0**	**0**	**3**	

	• Table top Aluminum profile modular flat demo panel rack with tiltable lockable frame 0-90° in steps to mount various types of SPV modules. Employs 1000W halogen lamps as variable intensity sun simulator. • Useful for laboratory experimental learning by students in renewable energy basics, energy conservation, charge controller, storage system etc. • Set of Instructor Guide & Student Workbook. • Trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there & shrouded 4 mm banana patch cords & shrouded sockets arrangements for the safety of the students • **TECHNICAL SPECIFICATIONS** **SPV Stand- 2 Nos.** • SPV module details (Specification subject to change) **Instrumentation power supply cum multichannel DPM panel** • +12V, -12V, @500 mA. & +5V@300 mA. • Multi channel DPM for temperature display. • 20 pin FRC power bus to supply power to neighboring SCR actuator cum sensor signal conditioning panel **SPV rating W/V/A/No. of cells per module** **1. 20/21/1.2/36-** SPV dim. (HXWXT) : 485x350x22 Rack dim. (HXWXD) : 910x530x300 Profile size: 30x30 SPV stands : 2 Seriesl /Parallel: Series Max Rating: 40W/42V												

	Default: Yes **• SCR based AC controller to set intensity of halogen lamp.** • Supports signal conditioning circuit for temperature to give output 0-2.5Vdc. D) Main rack - 1 No. Consists of table top aluminium profile rack (45x45) holding various panels DC Application panel • Common 12V DC fan for both solar cell & SPV • Separate LED lamps for 3V solar cell & 12V SPV **DC voltmeter & DC Ammeter panel** • DC voltmeter (0-50V) • DC ammeter (0-5A) with polarity protection diode. • Stand-alone Inverter Panel • I/P DC voltage-10-15Vdc, O/P AC voltage- 230Vac • O/P power rating- 210 VA **MPPT Charge Control Panel** • Rated voltage- 12Vdc, Max current- 6A • Max PV voltage-15V • Min PV voltage-10V • Battery rated voltage- 12V, Capacity- 7Ah • Battery type- Lead acid **Lamp load panel** 230V/15/40/60/100W x 3 bulbs with individual ON/OFF using 6A toggle switches. AC voltmeter & AC ammeter panel Voltmeter: 300V, Ammeter: 0.5A												

	Rheostat as load for SPV modules (600E/1A)- 1 no **PC interface needs following additional panels & S/W** MPPT charge controller Panel - 1 no 2 IGBT modules, 1st for charging control & 2nd for load ON/OFF 4 nos of analog outputs AI (0-2.5V) for RE voltage, RE current, Battery voltage & Load voltage 2 nos of DAC inputs for PWM control and load ON/OFF Battery rated voltage- 12V, Capacity- 7Ah Battery type- Lead acid **Computer interface Panel - 1 no** Connects to PC (Win7/8/10) USB port through USB IO module & type A to mini B cable 8 ADC channels I/P: 0 to 2.5V FS with 1 no. input simulation pot. 2 DAC channels O/P 0-2.5V FS V to I function block: I/P 0 to 2.5V and O/P 0-20 or 4-20mA (100 ohm load) switch settable. I to V function block: I/P 4 to 20mA and O/P 0-2.5V USB converter to interface 25 pin D connector on CIP panel to USB enclosed in 25 pin D shell using type A to mini B type cable **Software on CD** Virtual Workbench (VWB) software package is a USB based software working on windows dot net platform coupled with USB IO module useful as general purpose utility which supports different control strategies like single or multi loop PID controller, fuzzy controller etc., graph plotting in XY, XT & polar mode etc., Modbus												

	interface, data logging, event trigger, function generator, DPM, MPPT controller etc. **List of experiments :** 1) To demonstrate the I-V & P-V module with varying radiation & temperature level 2) To demonstrate the I-V & P-V characteristics of series combination of PV module 3) To demonstrate the I-V & P-V characteristics of parallel combination of PV module 4) To show the effect of variation in tilt angle on module power 5) To demonstrate effect of shading on module output power 6) To demonstrate the working of diode as blocking diode 7) To draw charging & discharging characteristics of battery 8) Observe the O/P waveform of inverter in auto mode 9) Workout power flow calculations of standalone PV system AC load with battery 10) Workout power flow calculation of standalone PV system DC load with battery 11) Find MPP by varying the resistive load across the PV panel 12) To study effect of shading on the O/P of solar panel 13) To study battery characteristics 14) To understand & determine the DC flow in a solar system 15) To understand how a solar PV standalone system works 16) To determine power flow in a solar system												

	WIND ENERGY TRAINER TECHNICAL SPECIFICATIONS •Table top wind tunnel with side/ top covers having transparent viewing window & protection cage to facilitate identification of components of windmill. • 3 phase motor with axial fan blades as blower to simulate variable wind. • VFD to control speed of motor/ blower with continuously variable speed to set wind speed. •Renewable energy basics, energy conservation, charge controller, storage system & invertor etc. •Converting kinetic wind energy into electrical energy in laboratory using BLDC generator. •500mm cuboid using aluminium profile, 2 such racks connected each other to form wind tunnel containing wind blower & wind turbine. •Pitching & yawing provision provided. Wind turbine mounted on Pillar with bearing to facilitate yawing. • Set of Instructor Guide & Student Workbook. **TECHNICAL SPECIFICATIONS** **A) Wind turbine & Wind blower** **Wind turbine** • O/P wattage- 100W • O/P voltage- 75V • O/P current- 2A • Blade dia. 550mm x 6 nos. •Nut & screw arrangement for pitching • Mounted on rotating table to facilitate yawning, tail length= 250mm **Wind blower - 1 No.** • 3 phase 4 pole induction motor with 19f shaft • Rated star 415VAC & Delta 230VAC, 1HP, 50Hz, 1450												

	RPM • Blade dia. 550mm x 6 nos. **Digital anemometer - 1 No.** • Anemometer to measure air flow with digital display (0.5", 4 digit LCD) • Measurement units- Air velocity: m/s, km/h, ft/min, knots • Measurement units- Air flow: CMM (m3/min), CFM (ft3/min) • Dimension/Wt.- 156x67x28mm/ 260g **B) Main rack/ Control unit** Consists of table top aluminium profile rack (45x45) in 4x3 matrix holding various panels as below Single phase supply panel • Single phase MCBs of 10A • Lamp load **IGBT controlled AC drive panel** • Input voltage: 230VAC, 50Hz • Output voltage: 3 phase 200 to 230VAC • Range (frequency control): 0.1Hz to 100Hz (50Hz factory set) • Control mode: Sine wave PWM • Capacity: 2HP with reverse & forward direction • DC Application panel (St3)- 1 no •12V LED lamp/ LED strip & fan. **Charge controller Panel** • Rated voltage- 24Vdc, Max current- 6A • Max generator voltage-25V • Min generator voltage-20V • Battery Capacity- 7Ah • Battery rated voltage- 12V • Battery type- Lead acid												

	Stand- alone Inverter panel I/P DC voltage-10-15Vdc, O/P AC voltage- 2 30Vac O/P power rating- 210VA / 500VA **DC voltmeter & DC ammeter panel** • DC voltmeter (0-50V) • DC ammeter (0-5A) with polarity protection diode. **AC voltmeter & AC ammeter panel** Voltmeter: 300V, Ammeter: 0.5A **Lamp load panel** 230V/15/40/60/100W x 3 bulbs with individual ON/OFF using 6A toggle switches. Rheostat for generator loading (600E/1A)- 1 no **C) PC interface provision to be provided.** • DC Multi Output power supply. • Provides 1 Ph. AC supply through 3 MCB's, 4A each to power up other panels in the rack. • Multi-channel DPM for temperature display. • 20 pin FRC power bus to supply power to neighboring • Green shrouded socket provided to extend earth **MPPT charge controller Panel- 1 no** • I 2 IGBT modules, 1st for charging control & 2nd for load ON/OFF • I 5 nos of analog outputs AI (0-2.5V) for RE voltage, RE current, Battery voltage, Irradiance measurement & Load/ battery voltage • I 2 nos of DAC inputs for PWM control and load ON/OFF • I Built in battery- 12V/7Ah, Type: Lead acid **Computer interface Panel - 1 no** • Connects to PC (Win7/8/10) USB port through USB IO module & type A to mini B cable												

	• 8 ADC channels I/P: 0 to 2.5V FS with 1 no. input simulation pot. 2 DAC channels O/P 0-2.5V FS • V to I function block: I/P 0 to 2.5V and O/P 0-20 or 4-20mA (100 ohm load) switch settable. • I to V function block: I/P 4 to 20mA and O/P 0-2.5V • USB converter to interface 25 pin D connector on CIP panel to USB enclosed in 25 pin D shell using type A to mini B type cable **Software on CD** • Virtual Workbench (VWB) software package is a USB based software working on windows .net platform coupled with USB IO module useful as general purpose S/W utility which supports different control strategies like single or multi loop PID controller, fuzzy controller etc., graph plotting in XY, XT & polar mode etc., Modbus interface, data logging, event trigger, function generator, DPM, MPPT controller etc. **List of experiments** 1) To study characteristics of wind velocity & generator power. 2) To analyze effect of pitching (blade angles) on performance of wind turbine. 3) To study yawing due to change in direction of wind. 4) To perform experiment to study working of inverter & calculate its efficiency. 5) To study VI characteristics of wind turbine. 6) To study working of MPPT charge controller. 7) To study working of DC application (load). **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there**												

	and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.											
58.	**Fuse & MCB Characteristics Trainer** **The Trainer should have following features** • The trainer has built in requisite relay testing kit typically consisting of voltage injector, current injector, elapsed time counter (1 msec resolution), trip logic etc. all mounted in a light weight sturdy Aluminum profile flat demo panel system. Do not need any separate relay testing kit. • Facilitates easy & safe wiring by students due to use of 4mm sturdy Shrouded banana patch cords & shrouded socket arrangements for high voltage circuits • Each panel has ABS molded plastic sturdy enclosure, & colorful screw less overlays showing circuits diagrams & its connection tag numbers for easy understanding & connection • Set of Instructor Guide & Student Workbook • Trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there & shrouded 4 mm banana patch cords & shrouded sockets arrangements for the safety of the students **Technical Specifications** The Trainer should have Aluminum profile sturdy Modular flat panel (table top) system, carrying various high voltage components housed in plastic enclosures (panel) to minimise shock possibility **Control Power Supply & 1 Ph. AC Distribution Panel**	2	1	0	0	1	1	1	1	0	7	

	• +12V, -12V, 500mA • +5V, 300mA • Unregulated 17VDC/750mA Variable voltage & current injector panel • Consist of 1 phase dimmer 230VAC/1A • Short circuit transformer with primary 230VAC/1A, secondary 0-2-8V/12A taps. Over current & elapsed time measurement panel • Consists of AC ammeter of 20A • Elapsed time counter range 999.001 sec, resolution 1 msec. **Fuse & MCB Panel** • Kitkat Fuse - 2Amp • MCB - 2Amp **Hall Sensor Based Zero Current Detector Panel** AC/DC current hall sensor (x2nos,): Closed Loop current measurement using Hall sensor IC (max. I/P upto 20A, 50/60Hz), Isolation = 2.1KV, Proportional O/P = 0 - 2.5V, 1 CH DC Voltage transducer (x2 nos): Using high speed opto coupler IC (max. up to 600Vdc), isolation = 2 KV, 1 CH Function Blocks Used : Precision rectifier (x 2 nos) with gain = 5, LPF (x2nos) with gain = 2, Span Zero Circuit to interface with ADC(0-2.5Vdc) for both current & voltage, only 1 functional block each supplied, 2nd , field failure / zero current detector with Relay NO-NC Contact. **List of Experiments** • To study & plot characteristics of Fuse • To study & plot characteristics of MCB .												

	Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.										
59.	**Air Circuit Breaker Trainer (Dismantle ACB)** **The Trainer should have following features** • The trainer has built in requisite relay testing kit typically consisting of voltage injector, current injector, elapsed time counter (1 msec resolution), trip logic etc. all mounted in a light weight sturdy Aluminum profile flat demo panel system. Do not need any separate relay testing kit. • Facilitates easy & safe wiring by students due to use of 4mm sturdy Shrouded banana patch cords & shrouded socket arrangements for high voltage circuits • Each panel has ABS molded plastic sturdy enclosure, & colorful screw less overlays showing circuits diagrams & its connection tag numbers for easy understanding & connection • Set of Instructor Guide & Student Workbook • Trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there & shrouded 4 mm banana patch cords & shrouded sockets arrangements for the safety of the students **Technical Specifications** The Trainer should have Aluminum profile sturdy	**1**	**0**	**1**	**0**	**1**	**1**	**1**	**0**	**0**	**5**	

	Modular flat panel (table top) system, carrying various high voltage components housed in plastic enclosures (panel) to minimise shock possibility **Control Power Supply & 1 Ph. AC Distribution Panel** • +12V, -12V, 500mA • +5V, 300mA • Unregulated 17VDC/750mA Variable voltage & current injector panel • Consist of 1 phase dimmer 230VAC/1A • Short circuit transformer with primary 230VAC/1A, secondary 0-2-8V/12A taps. Over current & elapsed time measurement panel • Consists of AC ammeter of 20A • Elapsed time counter range 999.001 sec, resolution 1 msec. **Fuse & MCB Panel** • Kitkat Fuse - 2Amp • MCB - 2Amp **Hall Sensor Based Zero Current Detector Panel** AC/DC current hall sensor (x2nos,): Closed Loop current measurement using Hall sensor IC (max. I/P upto 20A, 50/60Hz), Isolation = 2.1KV, Proportional O/P = 0 - 2.5V, 1 CH . DC Voltage transducer (x2 nos, one): Using high speed opto coupler IC (max. up to 600Vdc), isolation = 2 KV, 1 CH . Function Blocks Used : Precision rectifier (x 2 nos) with gain = 5, LPF (x2nos) with gain = 2, Span Zero Circuit to interface with ADC(0-2.5Vdc) for both current & voltage, only 1 functional block each supplied, 2nd , field failure / zero current detector with Relay NO-NC Contact.												

	Air Circuit Breaker (ACB)- Table top • ACB 3ph, 440V, 3 pole, 50Hz, fixed type • Rated current- 400A • Rated voltage- 415V • Rated S.C. breaking- 50KA • Rated (S.T.) with stand capacity 1sec- 50KA **List of Experiments** • To study & plot characteristics of Fuse • To study & plot characteristics of MCB • To study & plot characteristics of Air Circuit Breaker **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
60.	**Induction type electromagnetic relay trainer** **The Trainer set should consist of the following features:** • The trainer should consist of built in requisite relay testing kit typically consisting of voltage injector, current injector, elapsed time counter (1 msec resolution), trip relay logic etc. • The trainer should have a few set of associated relay testing (current / voltage injection etc.) panels (7-8 nos. typically) which are mounted in a light weight sturdy Aluminum profile flat demo panel system.	2	0	1	0	1	1	1	0	0	6	

	• Should have 4mm sturdy shrouded banana patch cords & shrouded arrangements. • Each panel should have ABS molded plastic sturdy enclosure, & colorful screwless overlays showing circuits diagrams & its connection tag numbers for easy understanding & connection • Should Facilitates easy & safe wiring by students due to use of 4mm sturdy Shrouded banana patch cords & shrouded socket arrangements for high voltage circuits & Set of Instructor Guide & Student Workbook should be provided • Trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there & shrouded 4 mm banana patch cords & shrouded sockets arrangements for the safety of the students **Technical Specifications of interfacing panels:** Aluminum profile sturdy Flat panel system carrying various high voltage components housed in modular plastic enclosures to minimize shock possibility. **1 phase AC Input supply panel** Should consist of • 1ph. MCBs of 4A/1.6A - 2nos. • Bulb Load. **Variable voltage & current injector panel** Should consist of • 1 phase dimmer 230VAC/1A • Short circuit transformer with primary 230VAC/1A, secondary 0-2-8V/12A taps.												

	Over current & elapsed time measurement panel Should consist of • AC ammeter of 20A • Elapsed time counter range 999.001 sec, resolution 1 msec. **Over Current Relay Panel** All the connecting of relay should brought out on this panel & it should consist of o 2 NO trip contacts. o Relay Coil **Protection relay type (Electro Mechanical)** Should consist of Electro Mechanical type IDMT over current relay. **The above trainer should cover following experiments:** 1. To plot Inverse Definite Minimum Time (IDMT) characteristics of over current relay. **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**												
61.	**Over current numerical relay trainer** **The Trainer set should consist of the following features:**	2	1	1	0	1	0	1	0	0	6		

	• The trainer should consist of built in requisite relay testing kit typically consisting of voltage injector, current injector, elapsed time counter (1 msec resolution), trip relay logic etc. • The trainer should have a few set of associated relay testing (current / voltage injection etc.) panels (7-8 nos. typically) which are mounted in a light weight sturdy Aluminum profile flat demo panel system. • Should have 4mm sturdy shrouded banana patch cords & shrouded arrangements. • Each panel should have ABS molded plastic sturdy enclosure, & colorful screwless overlays showing circuits diagrams & its connection tag numbers for easy understanding & connection • Should Facilitates easy & safe wiring by students due to use of 4mm sturdy Shrouded banana patch cords & shrouded socket arrange-ments for high voltage circuits & Set of Instructor Guide & Student Workbook should be provided • Trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there & shrouded 4 mm banana patch cords & shrouded sockets arrangements for the safety of the students **Technical Specifications of interfacing panels:** Aluminum profile sturdy Flat panel system carrying various high voltage components housed in modular plastic enclosures to minimize shock possibility. **1 phase AC Input supply panel** Should consist of • 1ph. MCBs of 4A/1.6A - 2nos.												

	• Bulb Load. **Variable voltage & current injector panel** Should consist of • 1 phase dimmer 230VAC/1A • Short circuit transformer with primary 230VAC/1A, secondary 0-2-8V/12A taps. **Over current & elapsed time measurement panel** Should consist of • AC ammeter of 20A • Elapsed time counter range 999.001 sec, resolution 1 msec. **Over Current Relay Panel** All the connecting of relay should brought out on this panel & it should consist of o 2 NO trip contacts. o Relay Coil **Protection relay type (Numerical)** Should consist of numerical type IDMT over current relay, current rating 5A, with current setting of 2-250% in seven equal steps of 2%, time setting 0.1 to 1. **The above trainer should cover following experiments:** 1. To plot Inverse Definite Minimum Time (IDMT) characteristics of over current relay. 2. To perform experiment on definite / instantaneous mode setting of the relay. .																

	Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.											
62.	**Percentage Biased Differential Relay Trainer** **Trainer set should consist of the following features:** • Facilitates differential protection of transformer or using differential relay & characterization of different relay. • Each of above trainer has built in requisite relay testing kit typically consisting of voltage injector, current injector, elapsed time counter (1 msec resolution), trip relay logic etc. • The Trainer need a few set of associated relay testing (current / voltage injection etc.) panels (7-8 nos. typically) which are mounted in a light weight sturdy Aluminum profile flat demo panel system. Do not need any separate testing kit. • Facilitates easy & safe wiring by students due to use of 4mm sturdy Shrouded banana patch cords & shrouded socket arrange-ments for high voltage circuits • Each panel has ABS molded plastic sturdy enclosure, & colorful screw less overlays showing circuits diagrams & its connection tag numbers for easy understanding & connection • Useful for Post Graduate projects & research purpose. • Set of Instructor Guide & Student Workbook	1	0	1	0	1	1	1	0	0	5	

	Technical Specifications of interfacing panels: Aluminum profile sturdy Flat panel system carrying various high voltage components housed in plastic enclosures to minimize shock possibility. **Input 3 phase DOL Starter panel** Should consists of • 4 pole MCB of 415 V/2A . • DOL 9A Contactor with 230V / 50 Hz / 11VA COIL . • Bimetallic thermal O/L relay with range 1.4A - 2.3A. **1 phase AC input supply panel** Should consists of • 1 phase MCB of 4A/1.6A - 2 nos. • Bulb load **Variable voltage & current Injector panel =2 nos.** **Should consists of** • 1 phase dimmer of rating 0-230VAC/0.75A. • Toroidal current injecting transformer of 100VA with primary 230VAC/1A, secondary-0-2-8V/12A. • All connections of dimmer & transformer should be brought out on shrouded sockets for easy connection. **3 Phase Bidirectional Power cum Energy meter panel** Should consists of • Bidirectional Multifunction • 3 phase 3/4 wire, 415VAC, CT Input 5A • LCD/LED display, Aux. supply 230V, 45-65Hz,5W, • V, I, Hz, Pf, KVA, KW, KWH. • Modbus RTU RS 485 connections.												

Over current measurement & Elapsed time counter panel =2 nos.
Should consists of:

- AC ammeter of 0-20A range, Aux. supply 230VAC, Display: 0-19.99.
- Elapsed time counter with display range 999.999 of resolution of 1msec. Should have facility to freeze time.
- Should have start-stop push buttons, provision to connect trip NO contact from protection relay.

Differential Relay Panel

All connection of relay should brought out on this panel & should consists of:

- o 2 NO Trip contacts
- o Aux. Supply 110VDC/230VAC

CT panel

Should consists of

- 5/5 Amp. CT 6 Nos.
- Primary side of CTs connection should brought on 3 x 2 x 2 SBS-5 sockets.
- Secondary side of CTs should be Star connected in group of 3 & brought out on 4 x 2 SBS-5 sockets.

415/230VAC, 1KVA, Star/Delta Transformer Panel

Should consists of 415/230VAC, 1KVA, Star/Delta transformer Panel
Consists of all the connections of transformer primary & secondary should brought on SBS5 on the top of panel.

Resistor Load (Table Top panel)

	Should consists of AC/DC Resistors 750E/600E/300E/212E/162E/ 125E/ 112E/100E/400W /8 taps + OFF + separate 60E tap for DC series Gen. **Resistive Load panel (Table Top panel)** Should consists of 3 nos. of 600W resistors with switch selectable 7 nos. of taps at 100, 112, 125, 150, 175, 200 & 225 Ohm **Protection relay type (EM/Static/Numeric) :** Should consists of Electromechanical or Numeric type High speed biased differential relay current rating 1A, with biased setting of 15%, 30 & 45% by plug board taps, Aux. supply 110VDC. **The above trainer should cover following experiments:** 1) To plot characteristics of % biased differential relay. 2) Pick up test for differential relay. 3) Transformer protection using differential relay for in zone trip faults. 4) Transformer out zone or non-trip faults. **Accessories: 3 ph variac 3A** **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**												

63.	**Motor Fault Simulator Trainer** **The Trainer should have following features :** • Easy & safe wiring by students due to 4mm sturdy shrouded banana patch cords & shrouded socket arrangement for high voltage circuits. • Facilitates easy learning about fault characteristics of ubiquitous squirrel cage induction motor. • Teaches troubleshooting through introduction of fault switches. • Each panel has ABS molded plastic sturdy enclosure, & colorful screw less overlays showing circuit diagram & its connection tag numbers for easy understanding & connections. • Set of Instructor Guide & Student Workbook. • Trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there & shrouded 4 mm banana patch cords & shrouded sockets arrangements for the safety of the students **Technical Specifications :** The Trainer should have Aluminum profile sturdy Modular flat panel (table top) system, carrying various high voltage components housed in plastic enclosures (panel) to minimise shock possibility. It should consists of : **Input 3 phase DOL Starter panel** • 4 pole MCB of 415 V/1A . • DOL 9A Contactor with 230V / 50 Hz / 11VA COIL. • Bimetallic thermal O/L relay with range 1.4A - 2.3A . **AC voltmeter panel** • AC voltmeter of 0-500V for three phase voltage measurement by selector switch.	1	0	1	0	1	0	1	0	0	4	

	• The selector switch facilate monitoring all three line voltages namely RY, YB & BR as well as 1 phase voltage monitoring. **Integrated AC (3/1 phase) measurement panel** • Digital meter (96X96mm) for measurement of 3Ø & 1Ø parameters. • Voltage line to line & line to neutral. • Current for all 3Ø up to 5A. • Power factor, frequency, watts, VAR, VA & energy in Kwhr. **FWD/REV, Star-Delta starter panel** • FWD/REV, 3 pole 3 way switch with centre OFF, 6A/440V. **3 Phase sequence indicator Panel** • Study 3 phase 440V Electric utility supply - Determination of over voltage, under voltage, single phasing & reverse phasing / Displays OV, UV, SP, RP on digital display **Single Phasing Panel** • Provided with three single-phase (SP) fault switches (DPST) one for each phase. • It utilizes three 230V bulbs star connected internally for indication of single-phase fault. • Each switch is connected in series with each bulb. • The bulbs provided are 15W rating. The other pole & way disconnects power to the panel there by simulating single phasing. **Grounding & Protection Panel** • This panel is Re-assembly where in 2 pole MCB is replaced by 2 pole ELCB (Earth leakage circuit breaker).										

	• The NC contacts of ELCB are to be connected in series with coil of main contractor. • One push button (NO) in series with SPDT selector switch to select either lo-leakage or hi-leakage simulated earth fault. • When push button is pressed live is shorted to earth through bulb to create earth leakage fault. • These devices are specifically designed to operate above certain threshold of fault level below which fault will have no effect. **3 Phase Induction Motor Fault Simulator Panel** • The top display box on the induction motor supports total 18 SBS5 of which 6 (3X2) are meant to feed input 3 phase supply output & rest are meant for making star-delta configuration. • This panel also supports 9 numbers of DPST fault switches **Motor Specifications :** 3 phase squirrel cage induction motor, ½ HP, 4 pole, 1500RPM, 6 terminal (delta 415Vac/star 440Vac) motor with built in thermal cutout (NC contact). **Fault simulator built on the panel on top of motor.** Sturdy toggle switches to introduce faults. **The Trainer should be capable of performing following experiments :** 1) Over current. 2) Under current. 3) High Temperature 4) Single phasing 5) Reverse phasing 6) Under voltage.												

	7) Over voltage 8) Winding open **Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.**											
64.	**On transmission line protection simulation trainer.** **Power Transmission Line Trainer** **SALIENT FEATURES** • Facilitates characterization of transmission line, load regulation, efficiency, power circle diagram, VAR Compensation, per unit representation, symmetrical & unsymmetrical faults, power flow, study & effect of Peterson coil etc. • Simulates 400 KV, 50 / 60Hz, 3 Phase 1MVA. Transmission Line by scaling it down by 1000:1. Second TL may be supplied for 3 bus experiments. • Trainer need a few set of associated panels which are mounted in a light weight sturdy Aluminum profile flat demo modular panel system. • Facilitates easy & safe wiring by students due to use of 4mm sturdy Shrouded banana patch cords & shrouded socket arrangements for high voltage circuits • Each panel has ABS molded plastic sturdy enclosure, & colorful screwless overlays showing circuits diagrams & its connection tag numbers for easy understanding & connection.	0	0	1	0	0	0	0	0	0	1	

	• Set of Instructor Guide & Student Workbook. Technical Specifications **Input 3 phase DOL Starter panel** • 4 pole MCB of 415 V/4A . • DOL 9A Contactor with 230V / 50 Hz / 11VA COIL • Bimetallic thermal O/L relay with range 2.5A -6A **FWD-OFF-REV, Switch Panel** • FWD/REV, 3 pole 3 way switch with center OFF, 6A/440V. • Integrated AC 3 phase measurement panel • Bidirectional Multifunction Meter • 3 Phase 3/4 wire, 415V, CT Input 5A • LCD/LED display, Aux supply 230V, 45-65 Hz, 5W • V.I., Hz, Pf, KVA, KW,KWH • Modbus RTU RS 485 **VAR Compensation panel** • Consisting of VAR compensating capacitors of 2, 4, 6, 8, 10 & 15μF each of 3 nos with 3 pole 7 way switch for selection. **Transmission line Panel Table Top Panel consisting of :** • Simulate model for transmission line constructed using R(10ohm/600W), L(0.15H/5A) & C (2.2uF/630V) 6 No. each component. • Can Simulate model for medium/long (125 km/250 km) length transmission line for p model. • Can Simulate model for medium/long (125 km/250 km) length transmission line for T model. • Fan cooled table top setup for long life. **RLC load panel** **Table Top Panel consisting of :** • 3 nos of 1KW resistors with switch selectable 1(off) + 6												

	nos. of taps at 100, 112, 150, 175, 200 & 225 ohm & SIL tap of 262 ohm. • 3 nos. of inductor 1.5H/1A with switch selectable 1(off) + 6 nos. of taps at 0.3, 0.6, 0.75, 0.9, 1.2 & 1.5H. • Capacitors 440VAC rating (3 nos, one per phase) with switch selectable 7 nos of value of 2, 5, 10, 15, 20, 30 & 50μF. • Fan cooled table top setup. **3 phase dimmer panel** **Table Top Panel consisting of :** • 3 phase dimmer I/P : 415VAC, 50Hz, O/P : 0 - 470VAC, 6A, 3 phase. **List of Experiments :** 1. Working with bi-directional 3 AC measurement panel, observing flow of real & reactive power & modbus communication with PC. 2. No load test & Ferranti effect. 3. Determination of transmission line constants (ABCD) by experimental measurement using 2-port method as well as by knowing components values & its verification. 4. Load Test & Calculation of Regulation, efficiency of Transmission Line by Laboratory measurement method. 5. Working with power circle diagram & to find steady state power limit of transmission line. 6. Capacitive VAR compensation 7. Per unit representation 8. Symmetrical & unsymmetrical faults in transmission line, LG fault with & without Petersen Coil. 9. Predicting Power Flow in Transmission Line (2 bus) by Numerical method [Newton Raphson / Gauss–Seidel Method/ Fast Decouple Method]												

	Inclusive of 2 Year of onsite warranty and trainer should be modular panels for easy site servicing not close control; panel box no wiring should not be there and shrouded 4 mm banana patch cords and shrouded sockets arrangements for the safety of the students STC.											
65.	**LCR Meter** Technical specification: display: 19,99 Count, Measurement frequency : 100Hz/120Hz/1KHz/10KHz/100KHz Measurement voltage : 0.6Vrms Output impedance : 120Ω LCR automatic identification/manual measurement Power : 9V	2	4	6	0	0	1	2	6	0	21	
66.	**Digital Multimeter** DC Voltage – 1000V, AC Voltage –750V DC Current --10 A, AC Current --10A, Resistance –20MΩ Display –2000 Counts LCD with Backlight, Measuring Category – CAT II 600V Special Function --- Diode test, Data hold, Continuity test/NCV test (LED, Buzzer, & EF Strength) Battery Life ---200 Hours typical Accessories –1 pair of test lead, spare fuse (0.2A/250V) x 2, Holster, Battery	2	5	6	0	0	1	3	6	0	23	
67.	**Tachometer** Display 5 digits (0.7") LCD white backlight display, Sampling time: 1 Sec (Over 60 RPM), Test range: auto ranging, Range I : 5-999.9 RPM, Range II : 1000- 99.999 RPM, Memory : Last Value, Max Value, Min Value ,	2	0	0	0	0	0	2	0	0	4	

	Operating temp. 0-50 degree C, operating humidity : less than 80% RH,											
68.	**Wire Striper** Length -150mm	5	6	6	0	6	5	2	4	0	34	
69.	**Pliers** 8 inch	5	6	6	0	6	5	2	6	0	36	
70.	**Ball pen Hammer** 500 gm.	5	6	6	0	6	5	2	6	0	36	
71.	**Earth tester** Earth Tester with Kit Rugged ABS body Easy to use hand held meter Ni-cd Re- chargeable Cells Confirms to ISS : 9223/1979 Four terminals {To measure earth resistance as well as specific soil resistivity} Lo-Bat or Δ indication appears on Display indicating that the indicating the the cells (batteries) have gone down, which can be recharged by connecting to 230V, 50 Hz AC mains supply through charging cord provided with the instrument Technical Details Display : 3½ Digits, LCD Dimensions (in mm) : 172 x 98 x 38 (Approx.) Weight : 575 gm. (Approx.) Electrical Specifications Insulation Resistance Test : More than 25 Meg ohms at 500 V DC between electrical circuit & containing case	0	0	0	0	0	2	0	6	0	8	

72.	**Tool kit** Tool kit 200 BP Hammer with handle, Screw driver set 821,Screw driver 725,Three in one tester 817 + 1413,Pliers 1621 6j,Rowel punch, Rowel plug 5 x 20mm Lubricating oil bottle, Knife, Nylon washer, Fuse wire 5 amp & 15amp,Insulation tape 20mm,Araldite-Hardner + Resin, M seal, Oil stone 1/2tri x 50mm,Nails 1/2 & 1,Nails 1 1/4,Nails 1 3/4,Woods screw 1/2,Woods screw 1	5	3	0	0	2	5	1	1	0	17	
73.	**Soldering iron 25 watt with Lead**	5	20	6	0	6	5	2	4	0	48	

Joint Director
Technical Education