DEEN DAYAL UPADHYAYA COLLEGE
(UNIVERSITY OF DELHI)
Sector 3, Dwarka, NEW DELHI-110078
Telephone Nos.: 011-25090381, 25099380
http://www.dducollegedu.ac.in

TENDER DOCUMENT

Ref. No.: DDUC/Tender/2017/1 **Dated: 2/1/2017**

The Deen Dayal Upadhyaya College invites sealed tenders/bids/quotations from reputed Original Equipment Manufacturers (OEM) or Authorized Distributors of OEM for the supply and installation of Sports equipment's for college gymnasium, and the Scientific Instruments/ items required for the laboratories of Department of Physics, Electronics, Chemistry, and Botany.

(Schedule of Tender)

Date of Issue of tender document	**2th January 2017 (Monday)**
Ref. No. of this tender	**DDUC/Tender/2017/1**
Tender Submission Dates	**All working days from 4th January 2017 to 25th January, 2017 (Wednesday) during office hours (9:00 AM to 5:00 PM) and/or on 27th January, 2017 (Friday) (From 9:00 AM to 11:30 AM)**
Last Date and Time for submission of tender	**27th January, 2017 (Friday) by 11:30 AM**
Availability of tender document	**The College website http://www.dducollegedu.ac.in**
Date, Time & Venue of Technical Bid Opening	**27th January, 2017 (Friday) at 12:30 PM in the Room No. 313, 3rd Floor, Deen Dayal Upadhyaya College Sector 3, Dwarka, New Delhi-110078**
Address for Communication and submission of Tender Document	***Principal,*** ***Deen Dayal Upadhyaya College,*** ***Sector 3, Dwarka, New Delhi-110078***

Attach a DD/Pay order for Rs.500/- favouring, Principal Deen Dayal Upadhyaya College, towards the cost of tender document (along with Technical bid)

The tenders must reach the Section Officer (Administration Section), Room No. 20, Ground Floor, Deen Dayal Upadhyaya College Sector 3, Dwarka, New Delhi-110078 by 11:30 AM, 27th January, 2017 (Friday) during office hours.

Terms and Conditions of the Tender

1. Eligibility Criteria

- The vendor should have reputed background and should be established in the business for at least 5 years. The turnover of the vendor should be at least Rs.1 Crore during the three years out of the last five years.

- Vendor must be a registered corporate entity in India. In case of companies incorporated outside India, they should mention an authorized service entity that would provide post purchase services on behalf of its principal.

- Vendor should have been making profits during at least 3 years out of last 5 years. Audited Balance sheet and Profit and Loss account (amount in Rupees) for last three years should be submitted. In addition, The College may ask for Income Tax Returns of the vendors if it deems necessary.

- Vendor should have executed at least 3 projects in the last five years for the equipment quoted to the Universities, Research Institutes or Colleges of repute in the Country. Documentary evidence is to be submitted for these 3 projects with contact details, name, Tel Nos. and Fax. Nos. of the previous customers. A complete list of all other places where similar systems have been supplied by the vendor is also preferred.

2. Two Bid System Tender

Separate Technical and Commercial Bids duly sealed and super-scribed ***"Quotations for Refer Annexure VIII-A to Annexure VIII-E"*** shall be submitted. Our Reference Number and date should be written on the envelopes.

1. **"Technical and commercial Bids"** to be submitted **in separate sealed envelopes.** Both the- envelops must be enclosed in a single big sealed envelope. Each one of the-envelops should be super-scribed **with our reference number** and due date given above along with the product name.
2. The technical bids will be opened individually, and examined for short listing the vendors, and the commercial bids of only those vendors who have qualified technically will be opened and compared.

The tender not submitted in the prescribed formats or incomplete in detail is liable for rejection. The Deen Dayal Upadhyaya College[1] is not responsible for non-receipt of quotation within the specified date and time due to any reason including postal holidays or delays.

ENVELOPE I (Technical Offer): The Technical offer should be complete in all respects and contain all information asked for, **except prices.** The Technical offer should include all details of specifications asked for in ***Annexure VIII A to VIII E.*** For example, Technical Offer should mention that 3 Years Warranty Period is included in the Commercial offer, without mentioning the actual amounts in the Technical offer. The suggested format for submission of technical offer is as follows:

[1] For the purposes of this Tender document the phrase "The College" means "Deen Dayal Upadhyaya College".

- All documents & certificates listed under **''Eligibility Criteria''** on page No. 2 of this tender document to be attached by the Vendor.
- Covering letter as per ***Annexure I***
- Earnest Money Deposit (EMD) **DD/Pay order** and details as per ***Annexure-II***
- Attach a DD/Pay order for Rs.500/- favouring, Principal Deen Dayal Upadhyaya College, towards the cost of tender document and details as per ***Annexure-II***
- Manufacturer's Authorization Form (if applicable) as per ***Annexure III***
- The Company profile as per ***Annexure IV and Annexure IVA***
- Details of 3 major projects / Colleges/ Universities/ Research Institutes, as per ***Annexure V***
- Details of Support / Service Centers as per ***Annexure VI***
- Vendor's Financial Details (audited balance sheets etc.) and other supporting documents, as asked in the tender document.
- Warranty compliance statement in ***Annexure VII***
- **Technical Offer for the listed items and instruments** given in ***Annexure VIIIA to VIIIE*** with all the columns filled in. **This should not contain any price information.** Each of the *Annexures VIII A to VIII E and its details are to be bundled / stapled separately.*
- Deviation table as per **Annexure IX** and **Annexure IXA.**
- Technical Documentation (Printed product Brochures and all technical leaflets, etc.) to be attached compulsorily with the Technical offer.

ENVELOPE II (Commercial Offer):

The Commercial Offer (C.O) should give all relevant price information as per ***Annexure X.*** The Bid Form must be filled in completely, without any errors, erasures or alterations. The Commercial offer must not contradict the technical offer in any way.

3. Documentation

The vendor shall furnish, as part of its tender offer, documents establishing the vendor's eligibility to participate in the tender and its qualifications to perform the Contract. The documentary evidence of the vendor's qualifications to perform the Contract, shall establish to The College's satisfaction that the vendor is eligible as per the criteria outlined in the Eligibility Criteria at Clause 1 on page 2.

4. Nontransferable Tender

This tender document is non-transferable. Any change in the constitution of the firm, etc. shall be notified forthwith by the contractor in writing to the tendering authority and such change shall not relieve any former member of the firm, etc., from any liability under the contract.

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 and conditions, and deposits with the tendering authority a written agreement to this effect. The contractor's 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.

5. Offer validity Period

The offer should hold good for a period of 60 days from the closing date of the tender. Any offer falling short of the validity period is liable for rejection.

6. Earnest Money Deposit

Vendor must submit Earnest Money Deposit (EMD) in the form of DD in favor of **Principal, Deen Dayal Upadhyaya College**, Delhi. The EMD amounts are determined by the amount of your bids as follows:

For Total Bid Amount	EMD amount
Upto Rs. 5 Lakhs	**Rs. 10,000**
From Rs. 5 Lakhs to Rs. 10 Lakhs	**Rs. 20,000**
From Rs. 10 Lakhs to Rs. 15 Lakhs	**Rs. 30,000**
From Rs. 15 Lakhs to Rs. 20 Lakhs	**Rs. 40,000**
Above Rs. 20 Lakhs	**Rs. 50,000**

The non-submission of EMD will lead to the rejection of the bid. The EMD of unsuccessful bidders will be returned to them within Three (3) months of selection of vendors. The successful bid, if withdrawn or fails to supply items within stipulated time, is liable for forfeiture of the EMD.

7. Manufacturer's Authorization Form

Vendors must submit a letter of authority from their manufacturers that they have been authorized to quote on behalf of the manufacturer **(Annexure III).**

8. Alternative offers

The offer should specify only a single solution for each listed item/equipment which is cost - effective and meets the tender specifications, and should as far as possible not include alternatives. However, offer the additional items required for better performance of the equipment must be quoted as option.

9. Costs

The offer should include the following:

- Cost of the equipment inclusive of all **taxes & statutory levies** and charges for onsite installations in the campus of The College.
- **3 years onsite comprehensive warranty** covering all parts & labours. This period will start from the date of installation and successful acceptance of all the goods by The College.
- Special discounts/rebates, wherever applicable, keeping in view that the supplies are being made to an educational institution, may please be indicated.

10. Erasures or Alterations

The offers containing unauthenticated erasures or alterations will not be considered. There should be no unauthenticated handwritten material, corrections or alterations in the offer. Technical details must be completely filled up. Correct technical information of the product being offered must be filled in. The College may treat offers not adhering to these guidelines as unacceptable.

11. Modifications and Withdrawal of Offers

The vendor may modify or withdraw its offer after its submission, provided that written notice of the modification or withdrawal is received by The College prior to the closing date and time prescribed for submission of offers. No offer can be modified by the vendor, subsequent to the closing date and time for submission of offers. In the event of withdrawal of the offer by successful bidders, the EMD will not be refunded by The College.

12. Preliminary Scrutiny

The College will scrutinize the offers to determine whether they are complete, whether any errors have been made in the offer, whether the required technical documentation has been furnished, whether the documents have been properly signed, and whether items are quoted as per the schedule. The College may, at its discretion, waive any minor nonconformity or any minor irregularity in an offer. This shall be binding on all vendors and The College reserves the right for such waivers.

13. Clarification of Offers

To assist in the scrutiny, evaluation and comparison of offers, The College may, at its discretion, can ask some or all vendors for clarification of their offer. The request for such clarifications and the response will necessarily be in writing. If deemed necessary, the vendor is required to give a presentation / arrange a demo of the items offered at the venue decided by The College.

14. Technical Inspection and Performance Evaluation

The College reserves its right to carry out a technical inspection and performance evaluation of equipment offered by short listed vendors.

15. Verification

The College reserves the right to verify any or all statements made by the vendor in the tender document, and to inspect the vendor's facilities, if necessary, to establish to its satisfaction about the vendor's capacity to perform the job.

16. Pre-dispatch Inspection

If considered necessary, The College, will inspect any, or all of the equipment at vendor's manufacturing site before shipment to verify that the equipment shipped to The College is as per the technical specification specified in the purchase agreement

The College may opt for third party confirmation for specifications of the product. In case the specification does not meet the requirements the party has to bear the expense for subsequent testing at their own risk and cost.

17. No Commitment to Accept Lowest or Any Tender

The College shall be under no obligation to accept the lowest or any other offer received in response to this tender notice and shall be entitled to reject any or all offers including those received late or incomplete offers without assigning any reason whatsoever. The College reserves the right to make any changes in the terms and conditions of purchase. The College will not be obliged to meet and have discussions with any vendor, and or to listen to any representations.

18. Short-listing of Vendors

The College will create a shortlist of technically qualifying vendors and the commercial offers of only these vendors will be opened. After opening the Commercial Offers of the short-listed vendors, if there is a discrepancy between words and figures, the amount indicated in words will prevail.

19. Award Criteria

This common tender has been issued purely for the convenience of The College. The evaluation of the tender will be carried by The College, and the contract will be awarded to the technically and commercially qualifying individually award contract for each of the equipment that is to be purchased.

20. Delivery & Installation Period

The College would like to have the following time schedule for completion of the activities from the date of placement of orders.

a) Delivery: 4-6 weeks

   Installation, testing and setting up the unit for continuous operation: 4 weeks from the date of delivery.

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

21. Performance Bank Guarantee

The selected vendors shall furnish 10% of the value of purchase order in the form of Performance Bank Guarantee issued by a Scheduled Bank for a period of three year. The period of three years will commence only after date of installation. Performance Bank Guarantee has to be deposited before release of payment.

22. Payment Terms

Payment will be made to the vendor after delivery and installation for all items at the scheduled destinations.

For imported items the payments will be made as per standard procedure.

23. Completeness of the contract

The contract will be deemed as incomplete if any component of the hardware, software, or any documentation / media relating thereto is not delivered, or is delivered but not installed and /or not operational or not acceptable to the Indenter after acceptance testing / examination. In such an event, the supply and installation will be termed as incomplete and it will not be accepted and the warranty period will not commence. The Warranty period will commence only on acceptance (based on acceptance test) of equipment by the Indenter.

24. Warranty

A. The 3 years onsite comprehensive warranty covering all parts & labor from the date of successful installation of the systems in the College. During the warranty period, the vendor will have to undertake comprehensive maintenance of the entire equipment, including hardware, software, equipment and accessories supplied by the vendor at the site of installation.

B. The vendor should have service center in Delhi (or if not in Delhi should carry the faulty instrument to the service center at its own cost) to ensure that the equipment is attended within a period of few days after the complaint is lodged.

C. The Vendor shall be fully responsible for the manufacturer's warranty for all equipment, accessories, spare parts etc. against any defects arising from design, material, manufacturing, workmanship, or any act or omission of the manufacturer / Vendor or any defect that may develop under normal use of supplied equipment during the warranty period.

D. The tenderer shall also be responsible to ensure adequate regular supply of spare parts needed for a specific type of machinery and equipments whether under their annual maintenance and repairs rate contract or otherwise.

Besides the above, the vendor will have to confirm the terms and conditions of warranty in ***Annexure VII.***

25. Liquidated Damages for delayed supply

If the vendor fails to deliver any or all of the equipment or does not perform the services within the time period(s) specified in the Contract, The College shall, without prejudice to its other remedies under the Contract, deduct from the Contract price, as liquidated damages, a sum equivalent to 2.0 percent of the price of the undelivered items the stipulated rate for each week or part thereof during which the delivery of such items may be delayed subject to a maximum limit of 10 percent of the stipulated price of the items so undelivered. Such penalty is to be deducted always from the bills of the firm OR to purchase elsewhere or from the Security Deposit on the account and risk of the vendor. Once maximum of the damages above is reached, the Indenter/purchaser may consider termination of the Contract and delisting the vendor on account and risk of the vendor.

26. Order Cancellation

The College also reserves the right to cancel the order in the event of one or more of the following circumstances:

- Delay in delivery and installation beyond a period of 6 weeks from the date of opening of Letter of Credit, or issue of Purchase order whichever is later.
- Serious discrepancy in hardware noticed during the pre-dispatch inspection, if any.
- Breach by the tenderer of any of the terms and conditions of the tender.
- Any action by the vendor which is in breach of law or accepted practices in commercial transactions
- If the Vendor goes into liquidation voluntarily or otherwise
- In addition to the cancellation of purchase order, The College reserves the right to forfeit the Performance guarantee submitted to The College by the Vendor and delisting the vendor.

27. Indemnity to Bank

The Vendor should furnish a photocopy of the Agreement with their Principals in respect of all products offered. Further, the vendor shall indemnify The College and keep indemnified against any loss or damage that The College may sustain on account of any violation of patents, trademark etc., by the vendor in respect of the products supplied.

28. Guarantees

The equipment must conform to the highest quality and standard. All equipment, hardware and related software, must be supplied with their original and complete printed documentation. Consistency must be maintained for the entire lot of the equipment offered. All the required quantity of an item in schedule of requirement must be of the same brand and same model number. Part numbers also must be same for all pieces of an item. The Vendor should not substitute any internal components or subsystems of equipment by similar items from a different manufacturer. All the equipment and peripherals should be supplied with the relevant interface cables.

29. Quantity of Items to be Purchased

The college reserves the right to increase or decrease the number of units to be purchased at the time of placing the purchase order. The college also reserves the right not to purchase items listed in the tender document. If the order is placed in excess of the quantities shown in the tender notice, the tenderer shall be bound to meet the requirement. Repeat orders may also be placed on the rates and conditions given in the tender provided that the period is not more than 6 months from the date of the purchase order.

30. Publicity

Any publicity by the vendor in which the name of The College is to be used should be done only with the explicit written permission of The College.

31. Force Majeure

The vendor shall not be liable for forfeiture of its performance security, liquidated damages or termination for default, if and to the extent that its delay in performance or other failure to perform its obligations under the contract is the result of an event of force Majeure. For purposes of this Clause, "Force Majeure" means an event beyond the control of the Vendor and not involving the vendor's fault or negligence and not foreseeable. Such events may include, but are not limited to, Acts of God or of public enemy, acts of Government of India in their sovereign capacity, acts of war, acts of The College in fires, floods and freight embargoes.

If a Force Majeure situation arises, the Vendor shall promptly notify The College in writing of such conditions and the cause thereof within twenty calendar days unless otherwise directed by The College in writing, the Vendor shall continue to perform it's obligations under the Contract as far as it is reasonably practical, and shall seek all reasonable alternative means for performance not prevented by the Force Majeure event. In such a case, the time for performance shall be extended by a period(s) not less than the duration of such delay. If the duration of delay continues beyond a period of three months, The College and the vendor shall hold consultations with each other in an endeavor to find a solution to the problem. Notwithstanding above, the decision of The College shall be final and binding on the vendor.

32. Resolution of Disputes

The College and the vendor shall make every effort to resolve amicably, by direct informal negotiation, any disagreement or dispute arising between them under or in connection with the contract. If after thirty days from the commencement of such informal negotiations, The College and the Vendor have been unable to resolve amicably a contract dispute; either party may require that the dispute be referred for resolution by formal arbitration. The **Principal, Deen Dayal Upadhyaya College,** shall appoint a **Sole Arbitrator** of the dispute who will not be related to the contract and whose decision shall be final and binding.

33. Jurisdiction

Any dispute arising out of this purchase shall be under the jurisdiction of the courts of Delhi.

34. Income Tax may be deducted at source as per rules.

35. Vendors may be subject to a financial viability check and may be required to take out a director's, bank, or corporate guarantee.

Annexure I

(On the vendor's LETTER-HEAD)

Date:

To
The Principal,
Deen Dayal Upadhyaya College
Sector 3, Dwarka
Delhi-110078

Dear Sir,

Sub: Your tender for Supply & Installation of "Quotations for Refer Annexure VIII-A to Annexure VIII-E"

With reference to the above tender, having examined and understood the instructions, terms and conditions forming part of the tender, we hereby enclose our offer for the supply of the following items as detailed in your above referred tender.

Basic Item No.	Item Description	Make & Model

We further confirm that the offer is in conformity with the terms and conditions as mentioned in your above referred letter and enclosures. We also understand that the Deen Dayal Upadhyaya College is not bound to accept the offer either in part or in full and that the Deen Dayal Upadhyaya College has right to reject the offer in full or in part without assigning any reasons whatsoever.

The name and mobile no. of authorized person to whom we may contact in case of any clarification are as under:

Name: _____ Designation_____

Mobile Nos._____ Email ID_____

Yours faithfully,

Authorized Signatories
(Name & Designation, seal of the firm)
Date:

Annexure II

(On the vendor's LETTER-HEAD)

Date:

To
The Principal,
Deen Dayal Upadhyaya College
Sector 3, Dwarka
Delhi-110078

Dear Sir,

Sub: Details of EMD and Payment of Tender Document if downloaded from Website.

1. With reference to the above tender, we have enclosed the required DD/Pay Order favoring **Principal, Deen Dayal Upadhyaya College** towards the Earnest Money Deposit as per details given below:

   DD/Pay Order issued by the----------(Name of Bank), ----------(Branch), ----------(Date), amounting Rs._____ and is payable at Delhi.

2. We have enclosed the DD/Pay order of Rs.500/- , favouring, **Principal, Deen Dayal Upadhyaya College**, towards the cost of tender document, as per details given below:

   DD/Pay Order issued by the----------(Name of Bank), ----------(Branch), ----------(Date), amounting Rs.500/- and is payable at Delhi.

Yours faithfully,
Authorized Signatories
(Name & Designation, seal of the firm)
Date:

Annexure III

Manufacturer's Authorization Form (MAF)

Ref: No._____

dated _____

To

The Principal,
Deen Dayal Upadhyaya College,
Sector 3, Dwarka,
New Delhi-110078

Dear Sir,

Tender Reference _

We _____ who are established and reputable manufacturers of _____ do hereby authorize M/s _____ (Name and address of Agent/Dealer) to submit the quotation, negotiate and conclude the contract with you against the above invitation for the tender offer

We hereby extend our full guarantee and warranty as per terms and conditions of the tender and the contract for the equipment and services offered against this invitation for tender offer by the above firm.

Yours faithfully,

Authorized
Signatories
(Name & Designation)
Date:

For and on behalf of M/s _____
(Name of manufactures)

(Note: This letter of authority should be on the Letter-Head of the manufacturing concern and should be signed by a competent person of the manufacturer)

Annexure IV

Company Profile

Details filled in this form must be accompanied by sufficient documentary evidence, in order to verify the correctness of the information.

S. No	Item	Details
1	Name of Company	
2	Mailing Address	
3	Telephone, Fax numbers, and email id	
4	Date of registration of the Company	
5	Year of commencement of Business	
6	Name and designation of the person authorized to make commitments to The College	
7	Contact details of the person authorized to make commitments to The College	
8	Turn over of the company 2011- 2012 2012- 2013 2013- 2014 2014- 2015 2015- 2016	
9	Profit of the company 2011- 2012 2012- 2013 2013- 2014 2014- 2015 2015- 2016	
10	Sales Tax/VAT/Service Tax Number	
11	PAN	
12	Whether direct manufacturer or authorized dealers	

Signature (Name & Designation)
Date:

(Note: This letter of authority should be on the Letter-Head of the manufacturing concern and should be signed by a competent person of the manufacturer)

Annexure IV A

CERTIFICATE FROM THE VENDOR STATING THAT THE COMPANY HAS NOT BEEN BLACKLISTED BY ANY GOVERNMENT ORGANISATION

The Principal,
Deen Dayal Upadhyaya College,
Sector 3, Dwarka,
New Delhi-110078

Dear Sir,

This is to certify that M/s _____ has not been blacklisted by any Government Organization before submission of the tender document.
Yours faithfully,

Authorized Signatories
(Name & Designation)
Date:

For and on behalf of M/s_____

(Note: This letter of authority should be on the Letter-Head of the manufacturing Concern and should be signed by a competent person of the manufacturer.)

Annexure V

To
The Principal,
Deen Dayal Upadhyaya College,
Sector 3, Dwarka,
New Delhi-110078

Dear Sir,

We hereby certify that we have executed the following 3 projects to completion on the similar items as offered in the present tender to other Government organizations/Educational Institutions/Universities/Govt. Research Organizations.

Note: Please quote only those projects which are of substantial value.

Name of the Vendor _____

S. No.	**Name of the Client**	**Equipment**	**Clients Contact Details (Including Name, E-mail, Phone and Fax No. and Proper Address**	**Remarks**

Signature (Name & Designation) Date:

(Note: This letter of authority should be on the <u>Letter-Head</u> of the manufacturing Concern and should be signed by a competent person of the manufacturer.)

Annexure VI

To

The Principal,
Deen Dayal Upadhyaya College,
Sector 3, Dwarka,
New Delhi-110078

Details of Support and Service Centers

Name of the Vendor _____

S. No.	Place	Own	Postal	Contact	Number of	Service
		Office/Franchise	Address	Person & Contact Details	engineers	Facilities available **(Describe in detail)**

Signature (Name & Designation) Date:

(Note: This letter of authority should be on the Letter-Head of the manufacturing concern and should be signed by a competent person of the manufacturer.)

Annexure VII

Warranty Compliance Statement

The Principal,
Deen Dayal Upadhyaya College,
Sector 3, Dwarka,
New Delhi-110078

Dear Sir,

Subject: Supply & Installation of .....

This bears reference to our quotation Ref_____ Dated _____ .

We warrant that everything to be supplied by us shall be brand new, free from all defects and faults in material, workmanship and manufacture and shall be of the highest grade, quality and consistent with the established standards for materials specification, drawings or samples, if any, and shall operate properly. We shall be fully responsible for its efficient operation.

We also confirm that all service related complaints will be attended within few working days period of 3 hours after the complaint is lodged.

During the warranty period in case of failing to repair the machine, we will provide a stand-by arrangement till the equipment is repaired.

Yours faithfully
Signature (Name & Designation) Date:

Annexure VIII-A

Technical Specification for Sports Equipment's

S.No.	Name of items	Qty.	Specifications
1.	Table Tennis Tables	09	The table should facilitate faster speed and a more even bounce and suitable for high level competitions. Top Thickness- 25mm (The 25mm playing surface, combined with a perfectly balanced undercarriage, ensures top playing characteristics and true bounce) Frame- 25*75 mm Wheel Size- 125mm No. of wheels- 4 driving wheels with rubber tyres with locks Paint-DuPont polyurethane anti-glare Size- 2740*1525*760mm Net weight- 140 Kgs Weight when packed- 180 Kgs Storage size- 180*162*72 cms Package size- 185*162*60 cms Volume- 180 cbm Assembly time- pre assembled Suitable for wheelchair players. Playing surface in green or blue Superior Nets & Clip Type Posts. Table tennis table covers Approved by ITTF (Approved by International Table Tennis Federation)
2.	Badminton Poles Moveable	02 Pair	Movable Posts with wheels with rubber tyres for Badminton as per International Standard with Weight 250Kg. In built net wire tightening system very easy to operate.
3.	Treadmill	01	SPEED : 0-20 KM/HR ELEVATION : 0-15% RUNNING AREA : 22" X 60" DIMENSION : 82" X 34" MAXIMUM USER WEIGHT : 180 KGS MACHINE WEIGHT : 215 KG STEP UP HEIGHT : 8.3" MINIMUM 5 HP AC PEAK MOTOR 1000LBS INCLINE THRUST MOTOR DISPLAY : 8 X 15 LED DISPLAY DISPLAY MUST SHOW: SPEED, DISTANCE, INCLINE, TIME, HEART RATE, CALORIE, CALOARIE/ HR, METS, Watts, PACE, GRAPHIC. Heart Rate Monitoring-contact and polar wireless Programs : Quick Start, Manual, 9 programs Including Heart Rate Control,1 mile Fitness Test Gerkin Protocol Must Speed and incline control keys must be located on the front Handle Cross Bar. must have International Compliance for Quality and Caliberations : FCC, EN, EC, ASTM, CSA, Deck Type : Phenolic, Belt : Pre-lubricated,

			multi-ply polyester, Intelligent Suspension system/Technology is required. In Deck: The point of Landing must be soft, Mid-point of Deck Firm and Rear Deck must be Stable, The Side Foot Rails Must be Made in Mild Steel and of plastic. Innovative and exclusive mobility/ transportation wheels for easy movement. ARMZ stability bars for added security. Ergonomically designed bars for added security and comfort. It helps to burn more calories while holding on an incline. Quick reference codes to provide users with easy access to equipment information and workout using smartphone mobile devises. Connectivity: made for Ipod and Iphone.
4.	Body Arc Trainer	01	Incline levels: 21 Stride length: 24 inch (61 cms) Resistance Range: Upto 900 Watts Drive Type: 2 stage drive Brake: Brushless eddy current brake with generator Dimensions: 76" L X 32" W X 62.5" H , 192 X 81 X 159 cms Machine Weight: 412 lbs (187 kgs) Maximum User Weight: 400 lbs (181 kg) Display: graphic display of profile 7 X 15 LED, Numeric display of time, distance, calories, calories/hr, METs, Watts, Strides/ min, Heart rate including multicolor indication of heart rate range, lower display shows time, Incline & resistance levels Workouts: Quick start, manual, 3 weight loss, 3 cardio 2 strength & heart rate control, programs have 10 levels to control both incline & resistance Power: self-powered and AC adapter version Compliance: FCC class B, ETL Listed to UL1647, ASTM, CE EN 957, CE Low Voltage Directive, EMC & RoHS Quick reference codes to provide users with easy access to equipment information and workout using smartphone mobile devises. Connectivity: made for Ipod and Iphone. Patented arc design that gives fast fitness results. Unique are motion, 3 in 1 machine with glide, stride and climb function, 21 incline levels and 24 inches stride length, same side forward motion.
5.	Recumbent Bike	01	Resistance Range: Min. 20 watts & Max. 900 Watts Modes of Operations: Bike Mode & Constant Power Mode Resistance Type: Hybrid Eddy current with brushless internal generator for low drag & high power capability Dimensions: 65" L X 25" W X 52" H (165 cm X 63.5 cm X 132 cm) Seat Adjustment by single handed from seated position, extra wide pedals design and pedal straps for user comfort, extra wide double sided pedal design accommodates any size foot, multi position handlebars. Robotically welded frame, three pieces, forged steel mountain bike cranks for low maintenance, self-tensioning powered drive for easier start-up and smoother operations, Work out Level: 21 Heart rate monitoring: Contact grips and wireless. Power: self-powered and AC adapter version Maximum User Weight: 400 lbs (181 kg)

			Display: 8 X 15 LED bar graph matrix, 7 segment LED modules & LED enunciator bar Programs: Quick start facility selectable as bike mode and constant power, weight loss and cardio workout are constant power, 4 weight loss, 4 cardio & Heart rate Control Compliance: FCC class B, ETL Listed to UL1647, ASTM EN 957, CE Low voltage Directives Display: Graphic display of profile via 8*15 LED; numeric display of time, distance, calories, calories/hour, METs, watts, RPM, and heart rate including multi-colour indication of heart rate range. Lower display shows road speed and resistance level.
6.	Upright Bike	01	Resistance Range: Min. 20 watts & Max. 900 Watts Modes of Operations: Bike Mode & Constant Power Mode Resistance Type: Hybrid Eddy current with brushless internal generator for low drag & high power capability Dimensions: 48" L X 22.5" W X 64" H (122 cm X 57 cm X 162.5 cm) Machine Weight: 142 lbs (64.5 kgs) Seat Adjustment; one hand ratcheting seat height adjustment with design features a comfort groove and shape to conform to the user. Display: Graphic display of profile via 8*15 LED; numeric display of time, distance, calories , calories/ hour, METs, watts, RPM, and herat rate range, lower display shows road speed and resistance level. Power: Self powered and AC adapter Maximum User Weight: 400 lbs (181 kg) Display: 8 X15 LED bar graph matrix, 7 segment LED modules & LED enunciator bar Programs: Quick start, 4 weight loss, 4 cardio & Heart rate Control, Quick start facility selectable as bike mode and constant power, weight loss and cardio workout are constant power Heart rate monitoring: contact grips and wireless Compliance: FCC class B, ETL Listed to UL1647, ASTM, CSA EN 957, EMC & RoHS Directives Three piece, forged steel mountain bike cranks for low maintenance. Self-tensioning powered drive for easy start-up and smoother operations. Traditional racing bars with dual heart rate contacts. Extra wide pedal design accommodates any size foot. Quick reference codes to provide users with easy access to equipment information and workout using smartphone mobile devises. Connectivity: made for Ipod and Iphone.

7.	Relaxation Chair	01	Length- 189 cms., Width- 73 cms., Height- 77.50 cms., weight- 126 Kg., Features- Automatic massage modes: 3D, ache improving memory ABC, fixed time, relaxed, comfort, full air pressure, waist stretch. The product should be designed with a set of smart 3D mechanical hands, which can move up and down, stretching back and forth, four-wheel drive with muted design. The shoulder part is designed with automatic detection and micro adjustment function; body curve and massage points automatic detection, it can automatically adjust the distance of massage hands' moving back and forth according to the detected body curve and massage points, to make the massage more humanistic and scientific. Comfort, ease, ache relieve, fast experience, relax, music sync, waist stretch, full air pressure and other specific massage functions. Set with two kind's memo massage functions M1 and M2. Manually select the upper body massage; three massage position options of overall, partial and fixed position; six massage methods of shoulder grasping, kneading, tapping, shiatsu, kneading & tapping and 3D; five massage speed levels available; under tapping and shiatsu massage status, the width of the massage hands can be adjusted in five levels. Arm air massage function (built-in 18 air bags, upper arm air massage function (built-in 4 air bags), with 3 intensity adjustments. Lower body air pressure massage function: back air pressure massage function (built-in 4 airbags), buttock air pressure massage (built-in 16 airbags), calf rest air pressure massage function (built-in 36 airbags), with 3 intensity adjustments. Back heating function, use carbon fiber as infrared heating source. The footrest can be extended to suit various heights. With slide rail structure on backrest, make a zero-space design to maximally save place. Calf rest lifting, backrest lifting and auto lying models adjustment. LED colourful lights on armrest. With negative oxygen ionizer on upper arm. Intelligent terminal (cell phone or tablet PC) control the massage chair by blue tooth. MP3 player function, upper arm built in 3D digital audio.

Annexure VIII-B

Technical Specification for Equipment's of Department of Physics

S.No	Name of Item	Qty.
1	**Set Up for determination of resistivity by Four Probe Method** **Description of the experimental setup** **1.** All Four Probes should be spring loaded, collinear, equal spaced and be mounted on Teflon bush. This arrangement is to be mounted on a suitable stand and leads are provided for the voltage and current measurement. **2.** Germanium crystal(pure/doped) in the form of a chip (approx. 1cm x 0.8 cm x 0.2 cm) should be provided as a sample (one extra Chip is required) **3.** Temperature range of Oven should be from 0 to at least 200°C (with over heating protection optional) **4. Multirange Digital Voltmeter** Range: X1 (0-200mV) & X10 (0-2V) Resolution: 100mV at X1 range Accuracy: ±0.1% of reading ±1 digit Stability: Within ±1 digit Input Impedance: not less than 1Mohm Display:3½ digit, 7 segment LED with auto polarity and decimal indication Overload Indicator should be present **5. Constant Current Generator**. : The current supply must be highly regulated and should have digital panel meters. Open Circuit Voltage: 18V Current Range 0-20mA Resolution 10mA Accuracy ±0.25% or ±1 digit or better Stability Within ±1 digit Load regulation 0.03% for 0 to full load Line regulation 0.05% for 10% change **6.** Oven power supply should be provided with on-off LED indicator	02
2	**Set up to determine hall coefficient and hall angle of a semi conductor** Hall Probe (Ge Crystal) : Ge single crystal with four spring-type pressure contacts should be mounted on a sunmica /bakelite strip With proper connecting wires. **Material should have following features:** Ge single crystal n / p type Resistivity: approx. 8-10Ω.cm Contacts: Spring type (solid silver) Zero-field potential: <1mV (adjustable) Hall Voltage: 25-35mV/10mA/KG . **Hall Effect Set Up (Digital) :** digital millivoltmeter should have Range: 0-200mV (100mV minimum) Accuracy: ±0.1% of reading ±1 digit **Constant Current Power Supply (**100% protection should be given against crystal burn-out If there is excess current.**)** Current: 0-20mA	2

	Resolution: 10μA or better Accuracy: ±0.2% of the reading ±1 digit Load regulation: 0.03% for 0 to full load Line regulation: 0.05% for 10% variation **Electromagnet and constant current power generator** The air-gap between poles should have the provision to be varied continuously with the help of knobbed wheel screw adjusting system. Field Intensity : approx. 10KG at 10mm air-gap with flat pole pieces Pole Pieces: approx. 7 cm diameter Energising Coils: Two, each having a resistance of about 12W Power Requirement: 0-90Vdc, 3A, if coils are connected in series 0-45Vdc, 6A, if coils are connected in parallel **Constant current generator** Current Range: Smoothly adjustable from 0-3A per coil, i.e. 6A(with possibility of reversing the direction of current) or better Load Regulation: 0.1% for load variation from 0 to max. Line Regulation: 0.1% for ±10% mains variation Display: 3½ digit, 7 segment LED DPM Power: 220V ±10%, 50Hz **The supply must be protected against overload, short circuit and transients.** **Digital Gaussmeter,** Range 0-2KG & 0-20KG Resolution 1G at 0-2KG range or better Accuracy : minimum ±0.5% or better Temperature Upto 50°C Display 3½ digit, 7 segment LED DPM with auto polarity and over flow indication Power 220V ±10%, 50Hz Transducer Hall Probe – InAs Special Feature Indicate the direction of the magnetic field	
3	**To Determine the wavelength of H-alpha emission line of H-atom** The Set Up should consists of the following: 1. Spectrometer (30"): made of Brass fitted with collimator, telescope, prism table made of brass, having Vernier made of GS material, micrometer slit made of SS, Grating holder made of aluminum casting with clamp made of phosphor bronze and prism holder. The reading lens may be given with the spectrometer 2. Heavy duty regulated shock proof Power supply for the hydrogen tube a) Casing for holding spectrum tube securely in place, and preventing user from touching electrodes. b) Flat black finish to help eliminate ambient light c) Shielded and spring-loaded tube sockets for inserting and taking out tubes while preventing breakage. d) On-off toggle switch for ease of use (three pin power plug, 220 ±10% V/50 Hz) 3. Hydrogen Discharge Tube of good quality 4. standard diffraction Grating of good quality(15000 LPI)	2

4	**Ballastic Galvanometer** The coil should be suspended by phosphor bronze strip and is fitted with an optically true concave mirror of 50 cm focus. It should have clamp and free arrangement It should have leveling screws and spirit level for balancing the coil Galvanometer Resistance – approx. 115 ohm CDR: approx. between 2000 ohm to 3000 ohm Sensitivity not less than 250mm per micro coulomb at one meter distance. Periodic Time : approx. 12 to 14 seconds It consist of Translucent plastic scale fitted in frame, Length 50 cms, division 25-0-25 and 0-50 cms. The scale is mounted on a stand and its height can be adjusted. The lamp housing is fitted with a lamp operated on Mains through a Step down transformer.(220 V ± 10%/50 Hz)	10
5	**Set up to Find the Coefficient of Thermal Conductivity of a good conductor (Copper) using Searl's Method.** Complete leak-proof set up with heating/Steam chamber of copper construction , heavy copper rod duly fitted in a Wooden box of teak wood, necessary hot-Plate for making steam and team generator With joint-less base, polypropylene aspirator Bottle of 10 liter capacity, constant water Level tank, Hotplate, Weighing Scale, silicon special tube for the Experiment. the insulating material in the box should have proper thermal insulation preferably of glass wool to prevent heat loss. (6 meters per set), 4 thermometer 110x1/2 degree.	03
6	**Millikan Oil Drop Method Setup**: 1. A oil drop chamber should have a pair of horizontal parallel plate electrodes separated by approx. 5 mm thick ebonite ring with a hole for viewing the oil droplets. An atomizer should be provided to spray the oil droplets from hole present in the upper plate . A device should be present to illuminate the space between the parallel plate electrodes. 2. There should be three leveling screws at the base in order to make the parallel plate electrodes perfectly horizontal and a water-level placed on top of the panel is essential to verify it. 3. A microscope with CCD camera (good quality) head is required to view and transmit image of oil droplets between the plate electrodes to the monitor. 4. A power supply with continuously variable voltage atleast in the range of 0 – 800 V is to be provided to the upper plate and the lower plate should be permanently grounded. 5. A digital voltmeter to measure the potential applied to the upper plate as well as 'Time Meter' should be provided to display the time for which the oil droplet is allowed to move between the plates. 6 . Further, a timing device with two keys i.e, .'Clear' key, and 'Start/Stop' should be there on the main set up. 7. A monitor of good resolution with graduated screen should be provided. A complete manual should be provided with procedure, description of apparatus and test readings. Extra bottle of Oil should be provided with the set up.	01

7	**Setup to determine Ionization potential of mercury** Setup Should have in built regulated power supply with two multi-range meters for measuring Voltage and current accurately Should be supplied with valve 2d21 (extra 2 valves should be provided) cost of additional valve should also be mentioned	3
8	**Reading Telescope with Stand** The telescope is fitted on universal clamp which can be moved on Steel pillar fitted on heavy tripod base with three leveling screws. The diameter of pillar should be approx half inch and length of the pillar should be approx. 2 ft. / 6 ft.	20
9	**To determine the wavelength of sodium using Michelson Interferometer.** Michelson interferometer –base made of aluminum, a moving mirror with two adjustable screws & mounted on the Quadrant rail. Micrometer assembly provided. Vernier of Micrometer reads 0.001mm and movement of micrometer is reduced 5:1 to measure 0.002mm. Transverse of micrometer is 5mm. Beam splitter & compensator plates should be mounted in an aluminum housing, fitting on a base at 45 deg. To the two reflecting mirrors. A telescope magnification 3x with a Ramsden eyepiece & a cross line reticule & mounting arrangement for telescope. A base with three leveling screw should be provided for stability. Instrument must have dust proof acrylic cover fitted on top. Screen to view and count the fringes is also required with set up. A heavy Cast Iron base with three leveling screw provide to have stability of the instrument. Unit required to be used with He-Ne laser 2mW with power supply and mounting /fittings compatible to this unit shall be supplied. Two Laser safety eyewear in the form of goggles should be provided and the price should be quoted separately	02
10	**Spectrometer (Least Count : 30 Sec)** A Spectrometer LC-30 Sec. made of Brass fitted with collimator, telescope, prism table made of brass, having Vernier made of GS material, micrometer slit made of SS, Grating holder made of aluminum casting with clamp made of phosphor bronze and prism holder. The reading lens is to be given with the spectrometer.	10
11	**Set Up to determine Coefficient of Thermal Conductivity of a bad conductor by Lee and Charlton's Disc Method** Complete leak-proof set up with Steam chamber of Brass construction Circular Disc conductivity of thin layers of material consists of cylindrical slab of brass approx. 12 cms in diameter and 12mm thick. On this rests of approx. 5cm deep hollow cylinder of the same diameter with inlet and outlet tubes for steam. Both cylinder should have radial holes for in section of thermometers. The material under test is placed between the two cylinders and duly fitted on a Retort stand, Stop Watch digital Racer make, Steam generator with joint-less base, Hotplate, Screw Gauge, Vernier Caliper And silicon special tube for the experiment (6 meters per set) accessories : 2 thermometer 110 degree Celsius (L. C. 0.5 degree), Bad conductor (2 No.)	2

12	**Set Up to determine Coefficient of Thermal Conductivity of Cu by Angstrom's Method** Complete set up – Copper Rod of approx. 25mm diameter, Length half meter, round, section with four holes to insert thermometers and Heat on insulated cover for safety. Outer cover made of brass, electrical heating arrangement provided duly fitted Heater at the one end of the rod. Two heavy terminals provided for Power Supply. All above fitted on solid wooden base made of teak wood. The Unit is further covered with Spl. Type of Thick shock proof Sheet. The measuring scale fitted on the top of base for measurement. Heavy duty Frequency based Power Supply: Range 50V/10 amps, mains operated 230 V±10%, 50 Hz, supplied with Stop watch-Digital-racer, thermometer Range: 10 Deg to 360 deg C, qty: 4 Nos. & heavy connecting Leads fitted with Thimble . set should be complete in all respect	2
13	**Set Up to determine Mechanical Equivalent of Heat, J, Callender and Barne's Constant flow method** Complete set up with leak proof, heavy Gauge material construction, teak wood Base, necessary vessels/cylinders made of brass, heater fitted in glass tube covered with wooden block & inside glass wool, Polypropylene aspirator bottle of 10 liter Capacity, Beaker made of Copper 1000 ml capacity-2 Nos, graduated plastic Measuring cylinder of 250 ml capacity, Four thermometers of 10-250 degree C Range, unit shall be supplied with Necessary good quality voltmeter and ammeter , mounted in Bakelite desk type stand with insulated terminals, standardized-spring loaded jewels, Power Supply of accurate control having battery eliminator, Rheostats necessary Weighing scale and silicon special tube for the experiment (6 meters per set).	2
14	**Set Up to study the variation of thermo E.M.F. of thermocouple with difference of temperature of its two junction** thermocouple with High Seebeck Coefficient i.e (copper constanton or better)with Micro-controller based measurement with Digital display of temperature of hot and cold side.	2
15	**Set up to Study of the Antenna Radiation Pattern (dependence of radiation on the angle on dipole antenna)** RF Generator : 750 MHz approx. (output adjustable) Tone Generator : 1 KHz approx. (output adjustable) Directional Coupler Forward & Reverse (selectable) Matching Stub : Slider type ;Antenna Rotation : 0-360 deg. Resolution 1 deg. (or better) Receiving Antenna: Folded dipole with reflector Detector Display : Level adjustable meter with LCD display Power Supply: 220 V ±10 %, 50 Hz ;Interconnections : 2 mm Banana sockets Main Unit should be separately provided with LCD display for SWR Separate unit for Matching stub should be slider type Independent Units for Detector , Transmitter mast , & receiver Mast. 10 Antennas to be provided with the Trainer . 1. Transmitting Antennas (10) • Dipole λ/2 • Folded Dipole λ /2 • Dipole λ /4 • Yagi UDA Folded Dipole (3 E) • Yagi UDA Folded Dipole (5 E); • Yagi UDA Dipole (5 E)• Hertz Antenna	1

	• Loop Antenna •Log periodic antenna • Helix Antenna & Detector antenna Accessories : 1. Detector Antenna folded dipole 2. Current Probe ; 3. Mounting stands ; 4. BNC-Tee 5. BNC-BNC adapter M ; 6. BNC-BNC adapter F 7. BNC-BNC cable ; 8. Aligner ;9. Operating manual 10. Matching stub ; 11. Radiation Pattern Plotting Software 12. Polar graph (2 types) ; 13. Antenna fabrication kit 14. Power cord ; 15 VIP Carrying case for access . Software: Should be supplied with simulation & basic technology associated with the teaching of antennas (Basic theory & simulation based on Antenna radiation patterns, power patterns, directivity, gain beam width , polarization etc. different classification of antennas and types of antennas). Software should be provided on USB drive which should act as a hardware lock also. Hard copy of complete manual regarding the procedure may also be provided.	
16	**Set up to Study of Microwave wave and its propagation (reflection, refraction, polarization and double slit interference)** Setup should be complete with Transmission, Reception and Measurement of Microwave Power with all accessories required. Digital displays should be provided for relative strength measurement of microwave. Set up should have facility for experiments of Reflection, Refraction, Polarization and Interference etc. Audio / Voice communication facility should be provided Detector probe should be provided for field detection Accessories should be provided packed in a carrying case Frequency of Operation : 10 GHz (approx);Power of Transmission : 10 -15 mW (approx.) Operating Voltage : 8 V (approx) Antennas for Transmission & Reception : Horn type Ganiometer Scale : 0° - 360° ; Tone Generator : 1 KHz Frequency Transmitter and Receiver arm length : 49 cm each (approx) Power Display : Digital, Relative Measurements Power Supply : 230 V ±10%, 50 Hz Accessories : Microwave Transmitter & Receiver , Transmitter & receiver Arms Ganiometer Base Unit , Detector Probe , Prism Metal Plates of different dimensions , Partial Reflectors Din Connectors Cables , Metal Plate holder ,Polarization Grille , Prism Stand , Mini Microphone Software: Should be supplied with simulation & technology linked with teaching of Microwave technology (theory & simulation based on Electromagnetic waves , Modes of Propagation , types of waveguides, Microwave tubes , active & Passive components). Software should be provided on USB drive which should act as a hardware lock also . Hard copy of complete manual should be provided	1

17	**Set Up To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR) technique/ To determine the refractive index of a dielectric using SPR technique**	2

TECHNICAL SPECIFICATION	DEFINITION
Measuring principle	Surface Plasmon Resonance
Excitation wavelength	685 nm, power = 5 mW (p-polarized)
Angular resolution	0.01°
Motor	Programmable micro-controlled stepper motor
Mode of operation	Concentric and coplanar movement of sample and detector in user defined steps
Rotation direction	Both clockwise and anti-clockwise direction (0.01°)
Power resolution	0.01 mW
Sensor	Gold coated substrate (3 Nos.), dielectric coated Au/prism (3 Nos.)
Measurement media	Solid, liquid or gaseous (optional)
Laser mount	Kinematic mount to align the laser beam precisely in horizontal direction with respect to prism table and detector
Detector	Silicon photo detector of high resolution (0.01 mW)
Measuring wavelength range of detector	500 nm to 700 nm flat field
Operating temperature range	5 ^{o}C to 55 ^{o}C
Electrical Power requirements	230 V, 50 Hz

(optional: 2 laser spectacles for the protection of eyes are to be provided, price is to quoted separately)

Note: A common switch is provided to operate both the stepper motors for the movement of prism table (sample) and detector to move them in clockwise and anticlockwise direction simultaneously in synchronized manner.

13. Soft switches are provided on the front panel to feed the desired angle of rotation to the prism table.

14. The entire system should be table top and attached to one unit only.

15. Vendor must at least have supplied three systems to the academic institutes and supply the list of these institutes with contact details.

16. Complete Manual should be provided.

18	**BH loop tracer system (**Not included in the earlier list**)** - Input 5V AC using function generator - Input impedance 50 Ohm - Output Signal 20 V AC - Frequency range 20 Hz to 1 Khz - Accuracy 1% or better - Resolution 0.1% or better - XY output for measurement - Overload protection - Current limit 1 A - Standard sample for testing - Measurement plot on Oscilloscope - Sample holder with primary secondary windings - Sample type cylindrical 5mm dia 15mm length System should have • Main BH unit • Sample holder solenoid with two windings • Output BNC leads • Power chord • Manual	1
19	**PE loop tracer system** - Input 5V AC using function generator - Input impedance 50 Ohm - Output Signal 2000 V AC - Frequency range 20 Hz to 1 Khz - Accuracy 1% or better - Resolution 0.1% or better - XY output for measurement - Overload protection - Current limit 2mA - Standard sample for testing - Output Signal level 5V - Measurement plot on Oscilloscope - Sample holder with temperature control - RT – 250 degree C using temperature controller - Reference capacitor and resistance 8 nos each - Circuit overload protection System should have **36.** Main PE unit (Unit should be short circuit and shock proof) **37.** Sample and Sample holder for pellet **38.** Output high voltage leads **39.** Power chord **40.** Temperature controller with heating arrangement for sample **41.** Manual	1

20	**To measure the Dielectric Constant of a dielectric Materials with frequency** Dielectric Constant - Input signal from LCR q meter or LCR meter - Output Signal 16 parameters - Frequency range compatible to LCR meter - Standard sample for testing Temperature range for furnaces and sample holders (RT to 400 deg C) - Accuracy 1degree - Resolution 0.1 degree - Heating rate 1 to 5 degree/min - Low noise BNC leads - Self correcting sample holder for noise reduction System should have a. a LCR meter (1 KHz to 100 Khz or more) i. Accuracy in frequency = 0.2 % or better ii. Sample and Sample holder for pellet b. BNC leads 4 nos c. Power chord d. Temperature controller with heating arrangement for sample - Manual with description of apparatus and test readings	1
21	**Set Up to study Electron Spin Resonance** (i) ESR Spectrometer,. radio frequency oscillator should have frequency range of approximately 12–16 MHz. E. Phase Shifter : 2.. 50 Hz Sweep Unit : 3. Power Supplies : a) D.C. Power Supply : should be be stabilized for ripple free voltage. b) Helmholtz Coils Power Supply : power supply should consists of a step down transformer (220 to 35 V AC). Variable coil current should be provided in 10 steps using a band switch. the current should be displayed on a 3 1⁄2 digit panel meter. 4.. Helmholtz coils fitted with R.F. Coil: One (. No, of turns: 500 in each coil, Diameter of the winding: minimum14 cm, Separation of the coil: minimum 7 cm 5.. Sample - DPPH (inside R.F. Coil) is to be placed in a plastic tube, 6. complete Manual. The setup should be complete in all respect.	1
22	**Set up to study Zeeman Effect** 1. High Resolution Fabry Perot Etalon 2. Low pressure Mercury Discharge Tube 3. H.V. Power Supply for mercury tube 4. Narrow Band Interference Filter, (Central Wave Length 546nm Tmax 74% or better HBW upto 8nm or better) 5. Polarizer with lens, 6. Optical Bench of good quality 7. CCD Camera: (High Resolution CCD Camera) 8. Telescope with Focusing Lens: 9. TV Monitor 14": 10. Electromagnet Field Intensity: 7.5KG at 10mm air-gap with flat pole pieces	1

	Pole Pieces: 50mm diameter Energizing Coils :Two, each with a resistance of about 3.0W Power Requirement :0-30Vdc, 4A, if coils are connected in series 11. Constant Current Power Supply (Protection against the overload/short-circuit) Current Range: Smoothly adjustable from 0–4A Load Regulation: 0.1% for load variation from 0 to max. Line Regulation: 0.1% for ±10% mains variation Display: 3½ digit, 7 segment LED DPM Power :220V ±10%, 50Hz 12. Digital Gaussmeter Range: 0-2KG & 0-20KG Resolution: 1G at 0-2KG range Accuracy: ±0.5% or better Temperature :Upto 50°C Display :3½ digit, 7 segment LED DPM with auto polarity and over flow indication Power 220V ±10%, 50Hz Transducer: Hall Probe – InAs Special Feature Indicate the direction of the magnetic field A complete manual with test reading is required. The setup should be complete in all respect.	
23	**Measurement of Susceptibility of Paramagnetic Solids by Gouy's Method** (a) Digital Balance, Capacity : upto max. 100 gm Readability : 0.0001gms or better Repeatability : (+/-) 0.1mg Linearity : (+/-) 0.2mg or better Complete with weigh below hook **feature** Sample should be in the form of a long rod (Aluminium) and Glass Tube **Electromagnet** Pole Pieces : 75mm tapered to 25mm Mag. Field : approx. 20KG at 6 mm air gap /10 KG at 1 cm air gap Energizing Coils : Two of approx. 13W each Power : 0-90Vdc, 3A, for coils in series 0-45Vdc, 6A, for coils in parallel **Constant Current Power Supply** **(**Protection against the overload/short-circuit) Current Range :Smoothly adjustable from 0-3A per coil, i.e. 6A Load Regulation: 0.1% for load variation from 0 to max. Line Regulation: 0.1% for ±10% mains variation Display: 3½ digit, 7 segment LED DPM Power:220V ±10%, 50Hz **Gaussmeter** Resolution:1 gauss at 0 to 2 kilogauss range or better Range : 0 to 2 KG and 0 to 20 KG Accuracy :±0.5% or better Temperature: Upto 50°C Display :3½ digit, 7 segment LED DPM with auto polarity and overflow indication Power:220V ±10%, 50Hz Transducer: Hall Probe – InAs Special Feature Indicate the direction of the magnetic field	1

	The whole set should be covered in cabin for safety. It should be complete in all respect.	
24	**MEASUREMENT OF SUSCEPTIBILITY OF PARAMAGNETIC SOLUTION BY QUINCKE'S TUBE METHOD** Quincke's U tube of borosil with wooden stand (with 2 extra tubes and stand) **Beaker:** Graduated- Borosil- 500ml & 100ml.Each Unit – 2 Nos. **Measuring Cylinder: Poly Plastic** – 250 ml-Qty: 1 no per set. **Filter Paper:** 5 Sets per unit packed. **Funnel:**Made of Glass- Borosil. Qty: 2 Nos Per unit Sample: MnSO4 2H2O , R D bottle **Electromagnet** Field Intensityapprox. 7.5 KG at 10mm air-gap with flat pole pieces Pole Pieces: 50mm diameter Energizing Coils Two, each with a resistance of about 3.0W Power Requirement 0-30Vdc, 4A, if coils are connected in series **Constant Current Power Supply**, Current Range: 0–4A Load Regulation :0.1% for load variation from 0 to max. Line Regulation 0.1% for ±10% mains variation Display 3½ digit, 7 segment LED DPM Power 220V ±10%, 50Hz Protection against the overload/short-circuit **Digital Gauss meter,** Range 0-2KG & 0-20KG Resolution 1G at 0-2KG range or better Accuracy : minimum ±0.5% or better Temperature Upto 50°C Display 3½ digit, 7 segment LED DPM with auto polarity and over flow indication Power 220V ±10%, 50Hz Transducer Hall Probe – InAs Special Feature Indicate the direction of the magnetic field **Travelling Microscope**(Horizontal and Vertical) The bed is of heavy casting, thoroughly aged, machined and is fitted with leveling screws. True achromatic objective with 7.5cm focusing distance (ii) 10X Ramsden eyepiece with fine cross wire Scale and Vernier (i) Horizontal scale: 20cm divided at 0.5mm interval (ii) Vertical scale: 15cm divided at 0.5mm interval (iii) Venier scales: 50 divisions with a least count of 0.01mm The set up is to be complete in all respect.	1
25	**Set Up To verify the Stefan`s law of radiation and to determine Stefan's constant (Using silver constantan thermocouple)** Setup – having Blackened hollow metal hemispherical body, fixed on wooden frame provided with three legs for stability, on top whole for thermometer , supplied with accessories – as Spot Reflecting Galvanometer- Res: 125 ohms, AC Working voltage -230V/50Hz, A constantan-Silver thermo couple Size one meter, fixed in glass tube with rubber cork, Steam Generator-2ltrs Cap, single Joint less made of Copper, a Resistance box, plug type range 1-10000 ohms, Silver disc provided with stand and connecting wires. (extra thermocouple of silver constantan should be provided with cost should be	1

	quoted separately)	
26	**Set up to determine the angular spread of He-Ne Laser using diffraction grating.** Basic unit – with He-Ne Laser with power supply -2 mW, One screen, a meter scale, Travelling Microscope and a Rod Type optical bench with Saddles. (optional: 2 laser spectacles to be provided, to be quoted separately)	1
27	**Set up to determine absorption lines in the rotational spectrum of Iodine Vapour.** Set up consist of Spectrometer LC: 20 Sec – base made of solid aluminum casting. Locking nut,bush, fine motion screws and leveling screws provided. Spindle & central assembly made of brass. Inbuilt light arrangement provide on Vernier and main scale. Prism table made of brass provide with spring leveling and manual locking screw provide for fine circular motion. Telescope and collimator with rack and pinion fine and coarse motion made of brass. scale/Vernier made of GS material. Achromatic objective. FL 230mm , Ramsden eye-piece –lens holder of brass, magnification 8x, Reticule-90 deg. Cross etched on grounded glass, Micrometer slit assembly made of Stainless steel, strip and slit aperture made of brass supplied with prism holder made of brass and grating holder made of aluminum casting with clamps made of phosphor bronze. Should be Supplied with all accessories – Diffraction Grating 15000 LPI, having Spl type of T shape Benchmade of MS material with leveling Screws with uprights, light source with light holder made of metal, Iodine Glass Tube duly top covered for safety for student having centrally heating arrangement inbuilt with Lens holder made of brass, tube size -half meter approx.. AC Power Supply, Mortar & Pestle for Iodine, One small Pack of Iodine wafers, Brush for cleaning the tube. One extra spare tube should be provided with the set-up. (cost of extra tube should be quoted separately)	2
28	**Determination of Planck's Constant and Work Function of Materials by Photoelectric Effect** 1. Photo Sensitive Device : Vacuum photo tube. 2. Light source : Halogen tungsten lamp 12V/35W. 3. Colour Filters : 635nm, 570nm, 540nm, 500nm & 460nm. Accelerating Voltage : Regulated Voltage Power Supply, Output: ± 15 V continuously variable through multi-turn pot Display : 3½ digit 7-segment LED Accuracy : ± 0.2% or better Current Detecting Unit : Digital Nano ammeter Range : 1000 mA, 100 mA, 10 mA & 1mA with 100 % over ranging facility Resolution : 1nA at 1 mA range or better Display : 3½ digit 7-segment LED Accuracy : ±0.2% or better 6. Power Requirement : 220V ± 10%, 50Hz. 7. Optical Bench : The light source can be moved along it to adjust the distance between light source and phototube scale length is 400 mm. A drawtube is provided to install colour filter, a focus lens is fixed in the back end.	2
29	**Set up to find the Inductance of the Coil using Anderson's Bridge Method** Set up should consist of the following: Main Features: R = The Decade resistance dials having range X1000 ohms, X100 ohms and X10 ohms. r= three more decades of same value as in R.	3

	S.= Two decade resistance dials having range x10 ohms and 0.1 ohms. P=Q=Two fixed resistances of 1000 ohms each. C=Two fixed standard capacitor. (in micro F) L=Three unknown inductances (in milli H). Inbuilt AC Supply frequency 1KHz, 5Volts D.C. Supply, galvanometer for DC Balance supplied with Head phone for AC/ With one electronic null Detector with sensitivity knob and selection switch marked with A.C. & D.C. both. Additional features optional - having arrangement to connect with CRO to have results- see picture attached herewith. Circuit is engraved and the components are mounted on the top of sun mica bakelite sheet. Patch cord suitable to the terminals are supplied with the board. A complete working manual containing theory circuit details and operating instruction is supplied with the experimental board. With on/off switch with indicating lamp	
30	**Set up to compare the capacitance using De Sauty's Bridge Method** Set-up should consist of the following. Main Features: R_1 = Three Decade resistance dials having range X1000 ohms, X100 ohms and X10 ohms. R_2= Three more decades of same value as in R_1 .C_1= Single decade Capacitance dial range of x 0.1 microfd. C2= Four unknown Capacitors fixed on the board. (Optional: should have the provision on the board that extra Unknown C can be added or removed) Inbuilt AC Supply frequency 1KHz, 10Volts (peak to peak) D.C. Supply supplied with Head phone/electronic null detector with sensitivity knob. Circuit is engraved and the components are mounted on the top of sun mica bakelite sheet. Patch cord suitable to the terminals are supplied with the board. A complete working manual containing theory circuit details and operating instruction is supplied with the experimental board. With on/off switch with indicating lamp . Additional features optional- having arrangement to connect with CRO to have results	3
31	**Set Up To study the polarization of light by reflection and determine the polarizing angle for air-glass interface with** : Prism 01 Spectrometer :A Spectrometer LC-30 Sec. made of Brass fitted with collimator, telescope, prism table made of brass, having Vernier made of GS material, micrometer slit made of SS, Grating holder made of aluminum casting with clamp made of phosphor bronze and prism holder. The reading lens may be given with the spectrometer. Device to measure Photocurrent at micro ampere level (or with better precision) with digital display, which can be fitted in eyepiece of telescope .	1
32	**E/M APPARATUS by magnetic focusing method Set Up** CRT (1-1.5ft long, Power Supply with short circuit protection, Voltage Range: 0-1500V, Current Range: 0-3Amp), Compass Box, Solid heavy base (metallic) with scale provided at base with proper insulation.	02
33	**To determine the Coupling Coefficient of a Piezoelectric crystal** D33 meter - Input 5V AC - Input impedance 50 Ohm - Output Signal 5V AC - Frequency range 520 Hz to 1 Khz	01

	- Accuracy 1% or better - Resolution 0.1% - Output for measurement in DPM - Standard sample for testing System should have - Main D33 unit (The unit should be shock proof) - sample and Sample holder for pellet - Output leads - Power chord - Manual	
34	**To study the elliptical Polarized light using Babinet Compensator** **(**Not included in the earlier list**)** Polarizer and analyzer made of Polaroid sheet should be mounted in rotators graduated in 36 0°(Least count of rotation 1°). A Rectangular Box with micrometer head having one quartz wedge mounted on running slide and other quartz is fixed to it. Quartz wave plate should be mounted in a rotator graduated in 360° (LC 1°) SOURCE i) Table lamp superior quality ii) Sodium Vapour Lamp with choke and enclosure	1
35	To study V-I characteristics of PN Diode, and Light Emitting Diode. 1. Diodes: Rectifier-4007 (Si), Signal diode-1N34 (Ge), Zener 4.7V and LED 2. Digital milliammeter 0-20mA(with minimum least count 0.01mA) and 0 -2mA (with min least count 0.001mA), 3. Digital Voltmeter 0-20V (with min Least count 0.01 V) 4. It should have regulated continuous and short circuit proof power supply	3
36	Set up to verify the Thevenin, Norton, Superposition, and Maximum power theorem. 1. Digital milliammeter 0-200mA(with minimum least count 0.1mA), 2. Digital Voltmeter 0-20V (with minimum Least count 0.01 V) 3. It should have regulated, short circuit proof and continuously variable voltage and current power supply suitable to the circuit board.	3
37	Set up to find the Q-factor and resonance frequency of Series and Parallel LCR circuit. 1. Inductance (of five different range of milli henry order) made of pot ferrite cores and capacitances(five to six different capacitors of the order of nano farad) of low loss factors, Resistance (of the order of 10 ohm, 100ohm , 500(approx)ohm, 1 k ohm) 2. Digital milliammeter 0-200mA (with minimum least count 0.1mA), 20mA(with minimum least count 0.01mA) and 0 -2mA (with minimum least count 0.001mA), 3. Digital Voltmeter 0-20V (with minimum Least count 0.01 V)	3

38	Set up to study Characteristics of Tunnel Diode 1. With Digital ammeters and voltemters for digital display of appropriate range 2. It should have regulated continuous and short circuit proof power supply of appropriate range	3
39	Function Generator (10MHz or better) Function: Sine, Square, Triangle ,Ramp ,Pulse ,TTL & DC, Freq. Range : 1 Hz to 10 MHz, Sine; Variable control between steps. Pulse duty cycle : 15% to 85 % min width 200 ns, Frequency Range and Mode Selection : Microcontroller based, Frequency Display : 20 X 4Alpha numeric LCD with backlit, Output Voltage : 20 Vpp open circuit, 20 & 40 dB (fixed) , 20 dB variable attenuation, Offset Range : ± 5 V DC adjustable, External Frequency counter: up to 40 MHz, Modulation: FM, Mod. Frequency: DC-20 KHz, 2 Vpp max. Accessories: BNC to BNC with gold plated connectors.	30
40	Digital Multimeter with Micro Amp Range Display resolution(counts) 6000 Analog Bargraph,Back-Light ,AC Bandwidth 1 KHz AC/DC Voltage Range 600 mV to 600 V AC/DC Current Range 60 µA to 10 A Ressistance Range 600 Ω to 60 MΩ Capacitance Range 1000 nF to 10 mF Temp. Range K : -40 to 1372 °C Connectivity,IR-USB and capability for wireless data transfer through Bluetooth adaptor Measurement Category CATIII 600 V	50
41	Desk Top Multimeter (Micro ampere range) Features 4½ digit Bench top Multimeter, 50000 counts, Dual Display for viewing two parameters simultaneously, Diode/continuity testing with Math Function DC Voltage Range: 500mV to 1000V with resolution of 10 µV at 500 mV range Basic DC Voltage Accuracy up to 0.012% or better AC Voltage Range: 500mV to 750V with resolution of 10 µV at 500 mV range AC/DC Current Range: 500 µA to 10 A with a resolution of 10 nA at 500 µA range Ressistance Measurement Range : 500Ω to 50 MΩ with resolution of 10 mΩ at 500Ω range Security : lock slot security Math Function 6 Built in Function	30

42	Digital Storage Osciloscope Bandwidth 100 MHz with furture upgradability capability No. of Channels 2 Maximum Sample Rate 1GSa/s per channel Display Size 8 inches or better Time Base Accuracy 25ppm ± 5ppm per year MSO Upgradability up to 8 Channels Inbuilt Function Generator 20 MHz or better Inbuilt Digital Voltmeter 3 Digit Max Memory Depth 100 kpts Vertical Sensitivity 1 mV/div to 5 mV/div Vertical Resolution 8 bits Time Base Range 5 ns/div to 50 s/div Waveform Update Rate >50,000 wfm/s Operating Temp. 0 to +45 °C or higher	15
43	Power supply (Triple output) Input Voltage 230V AC, ±10%, 50Hz, 1 Phase Output Voltage and Current 0 to 32V/2A ±12V to ±15V/0.5A 4.50 to 5.50V/5A Line Regulation ±0.1% Load Regulation ±0.1% Output Ripple 1mVrms Operating Temp. 0 to 50ºC 3 Digit Display V & I Display Accuracy ±3 counts Electrically FloatingOutputs Upto 500V DC w.r.t. Ground	30
44	Set Up To Study Characteristics of Series RC Circuit. With digital meter of appropriate range. Different combinations of resistances and capacitors, DC regulated power supply with overload and short circuit protection	3
45	Set Up To Study Characteristics of Series RC Circuit. Without digital meters. Different combinations of resistances and capacitors, DC regulated power supply with overload and short circuit protection	3
46	Benchtop LCRQ-D Bridge -Meter Variable Measured L, C, R, Q and D Measurement Modes Series or Parallel Sort Modes Absolute value or nominal value Measurement Frequency Selectable 100 Hz or 1KHz or higher Accuracy ±0.25% of nominal Max Voltage across 0.285Vrms (0.8V p-p) Display 4 digit LED Connecting to Component Under Test 4 terminal integral test jig Measurement Range : Inductance 0.1µH to 9999H Cap. range 0.3pF to9999µF Input Impedance 0.001Ω to 100Ω Resolution Inductance : 0.1µH ,Capacitance : 0.1pF ,Resistance : 0.001Ω Quality Factor : 0.01 Input protection The input is protected against connection of capacitor of upto 10mF charged to not more than 50V	2

47	I.C. Tester (Digital) Should Have facility to : Test range of Digital IC such as 74 Series, 40/45 Series of CMOS IC's Test Microprocessors 8085, 8086, Z80 Test Peripherals like 8255, 8279, 8253, 8259, 8251, 8155, 6264,62256,8288,8284. Test 7 segment display of common cathode & common anode type Auto search facility of IC's Test by Truth table/sequence table comparison 40 pin DIP ZIF sockets should be provided Display 9 Digit Seven Segment The IC Tester Should Have Facility to Test : Digital TTL 74XX Series of ICs, CMOS (CD 4XXX Series) , Memories : 2102 2114 2115 2125 2147 2148 2149 6116 6264 62256 621024 9101 91L22 93412 93422 93425 41256 4256 50256 NV RAMS : 1220 1225 1230 1235 1240 1245 2210 2212 CPU :8085 8086 V20 8088 8400(Z80) 6502 65C02 65SC02 Peripherals :8155 8156 8205 8212 8216 8226 8237 8251 8253 8254 8255 8257 8259 8279 8282 8283 8284 8286 8287 8288 8250 82450 6350 6820 6821 6822 6840 6844 6845 6850 6851 6852 6854 6520 6521 6522 6524 6551 65C51 8420(Z80PIO) 8430 (Z80CTC) 8440(SIO-0) 8441 (SIO-1) 8442 (SIO-2) 8449 (SIO-90) 1852 1871 1879 2681 Transistor Arrays ULN : 2001 2003 2004 2005 2011 2013 2014 2015 2021 2023 2024 2025 2064 2065 2066 2067 2801 2803 2804 2805 2811 2813 2814 2815 2821 2823 2824 2825 RCA : 3083 3086 75468 75491 75492 Latch/drivers : UCN4801 UCN5801 Line Drivers & Receivers :26LS31 26LS32 743037 743038 75174 75175 75176 75182 75183,75450 75451 75452 75453 75454 8820 8830 96174 96175	2
48	Microprocessor Kit (8085 Microprocessor) 8085CPU@6.144MHz, 32K EPROM, 8K/32K RAM, Mem expansion-64KB, 48 I/O Lines & 3 Timer Counters, RS-232-C I/F, Assembler/Dissembler, 50 Pin FRC connector, 16*2 / 20*2 LCD Display, 104 Keys Kbd, RTC(optional). In Built Regulated Power Supply	40
49	Set up to study the V-I & Power Curves of Solar Cells, and maximum power point & efiiciency. Solar Cell Panel, Solar Cell Charachteristics Module, Effective area choppers (at least six nos.), Colour Filters(at least eight), connecting cables, table lamp for exaperiment on rainy day or cloudy day with arrangement to very the intensity of light, base plate and panel mount for solar cell with marking of the angles.	3
50	Set up to study the charachteristics of Bipolar Junction Transistor in CE configuration Input, Output and Transfer Characteristics:Digital ammeter and Digital voltmeter (2 mA,20V, 20V/20mA) 3 1/2 digit Display It should have regulated, short circuit proof and continuously variable voltage power supply suitable to the circuit board.	3

51	Set up to study the various biasing configuration of Bipolar Junction Transistor for normal class A operation Study of Q point for Fixed Bias, Collector Bias, Self Bias, It should have regulated, short circuit proof and continuously variable voltage power supply suitable to the circuit board.	3
52	Set Up to study the frequency response of voltage gain of a two stage RC-coupled transistor amplifier With and Without Feedback It should have regulated, short circuit proof power supply suitable to the circuit board.	3
53	Set Up To determine Boltzmann constant using PN junction diode THE EXPERIMENTAL SET-UP CONSISTS OF THE FOLLOWING 1. With Digital milliammeter 0-20mA(with least count 0.01mA) and 0 -2mA (with least count 0.001mA), 2. With Digital Voltmeter 0-20V (Least count 0.01 V) 3. It should have regulated, short circuit proof and continuously variable voltage power supply suitable to the circuit board.	3
54	Set up to study the V-I charachteristics of Zener diode and its use as voltage regulator Trainer to Study of Zener Diode as a Voltage Regulator, Transformer : 0 - 9V, 500mA (approximate) Filter : Capacitive 1000μF, 35V Zener Diode : Vz = 5.6V ; I ZM = 178mA Potentiometer, P1 : 4.7kΩ ; Potentiometer, P2 : 4.7kΩ	3

Annexure VIII-C

Technical Specification for Equipment's of Department of Electronics

S.No	Name of items with specification	Qty. Reqd.
1.	**Desauty's & Schering Bridge Setup** • Should Have separate Blocks for Desauty & Schearing Bridge • Should Have Built in Sine wave generator : • Frequency range : 1 KHz ; Amplitude control output : Sine wave : Up to 15 Vpp • Digital Meter : 200 mV as null detector ; Fuse : 500 mA, slow blow • Unknown Capacitors : 0.1 µF, 0.22 µF, 0.47µF • Mains : 100-230V AC, 50 Hz • Trainer should be on Legend PCB with no components on the top of board. Housed in a Moulded case with moulded cover on top.	3
2.	**Set up to determine the resolving Power and Dispersive Power of Diffraction and material of the given Prism with Spectrometer** • Set up – A Spectrometer LC-20 Sec. base made of Solid Aluminum casting. Locking nut, bush, fine motion screws and leveling screws provided. • Spindle & central assembly made of brass. • Inbuilt light arrangement provide on Vernier and main scale. • Prism table made of brass provide with spring leveling and manual locking screw provide for fine circular motion. Scale / Vernier made of GS material. • Achromat objective, FL 230mm, Ramsden eye-piece, lens holder of brass, magnification 8x, Reticule-90 deg. Cross etched on grounded glass, • Micrometer slit assembly made of Stainless steel, strip and slit aperture made of brass supplied with prism holder made of brass and grating holder made of aluminum casting with clamps made of phosphor bronze. • Supplied with all accessories. Spectrometer provided with light arrangement, sprit level, diffraction Grating – 15000LPI, Sodium light source set up-having sodium lamp, wooden box having three slits & transformer & Magnifier. Qty - Spectrometer – 1 No., Diffracting Grating -15000 LPI - 2 Nos, Crown Glass Prism, Size: 38x38mm – 2 Nos. , Sodium Lamp only – 2 Nos., Micrometer Slit-1 No-Extra, Magnifier LED-1 No & EDF Prism -38x38mm -1 no.	2
3.	**SCR Trainer Kit** - Trainer should have : • On Board DIAC, TRIAC & SCR. • Fixed DC power supply : +15V, Regulated ; ± 35V, Regulated • DIAC : DB3 ; TRIAC : BT136 & SCR : TYN616 • Resistor Bank • M.F.R. 2.2K 1% 1/4W (3 Nos.) ;M.F.R. 470E 1% 1/4W (3 Nos.) • M.F.R. 1K 1% 5W (3 Nos.) ; M.F.R. 4.7K 1% 5W (3 Nos.) • M.F.R. 1K 1% 10W (3 Nos.)	3

	• Variable Resistance bank : 5K 10 turn Potentiometer (2 Nos.) • Digital Voltmeter : 0V to 99V ;Digital Ammeter : 0mA to 20mA • Bread Board : Dimension (mm) : 175 x 61 x 10 • Distribution strips : 2 ; Distribution holes : 200 • Terminal Strips : 1 ; Terminal holes : 640 • Mains power supply : 100-230V ±10%, 50Hz • Trainer should be on Legend PCB with no components on the top of board. Housed in a plastic case with cover attached .Inside of cover should contain details/diagrammatic details based on SCR,DIAC & TRIAC.	
4.	**Set to determine wavelength of Sodium Light using Newton's Ring Apparatus.** Set up – with Bridge type microscope Dovetailed cast iron carriage slides on a heavy cast iron base. Carriage must Have locking arrangement to arrest Coarse motion when fine motion screw is used. Locking & unlocking, motion in the total traverse provide for slow Motion screw. It is use for Microscope in either vertical or horizontal plane. Horizontal transverse 160mm, least Count 0.01mm, working distance 75mm Eyepiece 8x Ramsden, reticle 90 deg. Cross, total magnification 16x, Newton's Ring apparatus – Plano convex lens of 63mm dia and 200mm f.l. with Circular plane glass plate of equal Diameter, both mounted in a Bakelite Frame with three adjustable screws, for making proper contact for centering Newton's Ring apparatus, light reflecting Unit fitted on wooden frame, A Spherometer made of Brass, Wooden base for set up & Sodium light Source- consist of Sodium Lamp-35Watts, Transformer and Wooden box having three side slits. Bridge Type Microscope–1 No. Newton's Ring Apparatus–2 Nos. Light Reflecting Unit-1 No, Spherometer-1 no , Sodium Lamp only – 2 Nos. Wooden Table/Choki -1 no. Sodium Light Source–1Set, Magnifier-LED-1 No, Table Lamp-1 no.	2
5.	**To determine the wavelength of sodium using Michelson Interferometer.** Setup should consist of : • Michelson interferometer – base made of aluminum, a moving mirror with two adjustable screws & mounted on the Quadrant rail. Micrometer assembly provided. Vernier of Micrometer should read 0.001mm and movement of micrometer should be reduced to 5:1 so as to measure 0.002mm. Transverse of micrometer should be 5mm. Beam splitter & compensator plates mounted in an aluminum housing, fitting on a base at 45 deg. to the two reflecting mirrors. • A telescope magnification 3x with a Ramsden eyepiece & a cross line reticule & mounting arrangement for telescope. • A base with three leveling screw should be provided for stability. • Instrument must have dust proof acrylic cover fitted on top. • A heavy Cast Iron base with three leveling screw to be provided to have stability of the instrument. • Sodium Light Source-35Wats consist of Sodium Lamp-35w, Transformer and Wooden Box having three side Slits. Qty of Items to be supplied - Michelson Interferometer - 1 No, Dust Proof	2

	Acrylic Cover & Cast Iron Base with leveling screws, Sodium Light Source - complete with Sodium Lamp-35w, Transformer and Metal Box having One side Slit.	
6.	**Transducers Trainers:** **Measurement of Displacement using LVDT** • Measurement Range:20 mm (1=10 mm) • Excitation Frequency:4 KHz (approx..) ; Excitation Voltage:4 Vp-p (approx.) • Sensitivity:10 m V DC/mm ; Linear Range:Full Scale • Signal conditioner Output:0.1 V DC for maximum displacement • Display :3 ½ Digit LED with polarity Indicator • Micrometer Scale:25 mm ; Micrometer Least Count:0.01 mm • Test Point:8 ; Interconnections: 2mm Patch cords : 2 mm banana stackable • Accessories included: Mains cord, E-Manual **To study strain measurement using strain gauges and cantilever Assembly**. • Strain Gauge (350):4 Nos. Gauge factor:2.1 • Maximum bearable weight:500 gms. • Cantilever material: Stainless Steel ;Cantilever width :2.5 cm ; • Cantilever thickness:0.16 cm ;Cantilever length:20 cm • Bridge Voltage: + 8 V DC ; Bridge configuration :Full Bridge • Display:3 ½ Digit LED ; Test Points:8 Nos. ; **Optical sensor/ Transducer Trainer** The trainer should be able to perform following experiments: • Plot the characteristics of Optical sensors/ transducers like Photovoltaic cell, Photo transistor, Pin Photodiode & Photoconductive cell .Study of Signal conditioning circuitry required for above transducers • Transducers : 4 Nos. • Photoconductive Cell 2) Photovoltaic Cell 3) Phototransistor 4) PIN Photodiode • Light Source : Filament Lamp • Signal Conditioning Circuitry : 1) Power Amplifier , 2) Current Amplifier 3) DC Amplifier 4) Comparator 5) Electronic Switch 6) Buffer • Input Circuits : Rotary and Slide Potentiometers; Output circuits : Relay & Buffer **Temperature Transducer Trainer Kit** - Trainer kit should have : • On board signal conditioning circuitry containing (Instrumentation Amplifier, X100 Amplifier, DC Amplifier, Comparator, Electronic Switch, Input Circuits : Rotary & Slide Potentiometers), Built-in DC power supply, • Transducers : N.T.C. Thermistor, Platinum R.T.D., K Type Thermocouple, IC Temperature Sensor; • Heating Element : Wire wound resistance 47Ω, 7 W • Input Circuits : Rotary & Slide Potentiometers • Output Circuits : Relay & Buzzer;	4

	Common specifications for all modules • Interconnections: 2mm Patch cords : 2 mm banana stackable • Power Requirement:220V + 10%,50 Hz,3VA • Accessories Included :Mains cord, E-Manual, Standard Weights • Trainer should be encased in a plastic molded box ,with no circuitry components on the top of board only block diagram & LVDT/Adjustment presets & Cantilever/Relay should be provided on top of trainer .	
7.	**Measurement Bridges** **a)Wheatstone Bridge /Post office Box Trainer** Trainer should have on board • DC Power Supply : 5V ; Galvanometer Deflection : 30 – 0 – 30 ; • Resistance : 80 ohms ; Unknown Resistance : Type : Variable ; Range : 0 – 10 Kohms • Wire Samples : Constantan : 1 meter ; Nichrome : 1 meter • Mains Supply : 90 - 275V, 50Hz ; ; Fuse : 500 mA **b) Kelvin Bridge Trainer** Trainer should have on board • DC Power Supply : +5V • Known Resistance : R1=100KΩ, 20KΩ, 10KΩ ; R3=1KΩ, 200Ω, 100Ω • Unknown Resistance : 0.3Ω, 0.4Ω, 0.8Ω ; • DPM : 2V LED Display for Null Detection. • Power Supply : 220V ±10%, 50Hz • Trainer should be on Legend PCB with no components on the top of board. Housed in a Moulded case with moulded cover on top. Coloured Wall chart describing various Bridges should be supplied with above set of Bridges.	4
8.	**Band Gap & Resistivity of a Germanium crystal by four probe method** • Four individually spring loaded probe arrangement should be provided , Collinear and equally spaced probes should be provided LCD Display for simultaneous measurement of voltage, current and temperature. The probes should be mounted in a Teflon bush, which ensure a good electrical insulation between the probes; PC Interfacing and supporting software should be provided • Four Probes : Contacts : Spring loaded ; Space between Probes : 2 mm ±2% ; • Probes : Collinear • Sample :Material : Germanium Crystal ;Type :N/ P type • Oven :Max. Temp. :150°C; Heater Resistance : 45 Ω ; Heater Voltage : 45 V (approx.) • Measurement Unit :Display : LCD 16 x 2 Characters ;Range : 0-2 V • Constant Current Generator : Current Range : 0 to 20 mA ; Resolution:1 mA, Open Circuit Voltage : 18 V • Oven Power Supply :Input : 230 V AC ±10%, 50 Hz	4

9.	**Analog Communication Training System** Should have following Modules: **PAM/PPM/PWM Modulation & Demodulation Techniques Module** • Modulator and Demodulator on same board • Different type of sampling, Natural, Flat top, sampled and hold • On-board DDS Signal Generator for standard and arbitrary signals • Selectable sampling frequencies for PAM & Ramp frequencies for PWM and PPM • On board 2nd order Butterworth low pass filter • No components should be mounted on the top of the Trainer, only block diagram to be provided on the top. SMD LED Indicators • Modulation & Demodulation Techniques : PAM ,PWM & PPM , Line Coding Techniques • Internal Signal Generator : Direct Digital Synthesizer • Types of Signal : Sine, Square, Triangle, Arbitrary signals. • Frequency : 500Hz, 1KHz, 2KHz, 3KHz • External Signal :Types of Signal : Sine, Square, Triangle, Arbitrary signals • Maximum Input Voltage : 3Vpp (Max.) +1.5V DC offset; Frequency : 500Hz to 3.5KHz • Sampling/Ramp Frequencies : 1.25KHz,2.50KHz, 5KHz, 9.80KHz, 19.53KHz,39.06KHz,78.13KHz • Crystal Frequency : 20MHz ; Selection Mode : Push switches • Random Data (For line Coding) : 8 Bit/ 16 Bit/ 32 Bit • Data Frequency : 500Hz, 1KHz, 2KHz, 3KHz ; Low Pass Filter : Cut-off frequency-5KHz • Test Points : 25 nos Minimum **b) FM Modulation & demodulation communication Module** • On board Functional blocks with self explanatory waveforms and technical details • On board Audio Oscillator, Frequency modulators/demodulators, Mixer/Amplifier, Amplitude limiter & Filter circuits • Effect of noise on the detection of FM signal should be investigated • LED indication for signal flow and selection • Minimum 40 nos. Test points for waveform observation and analysis • 12 Switched faults for troubleshooting at different functional blocks • Audio Oscillator : Sine wave (10Vpp adjustable) Frequency (300 Hz - 3.4 KHz) • FM Modulators : 3 nos. • Reactance Modulator : Carrier Frequency 455 KHz (± 3KHz) ; Varactor Modulator : Carrier Frequency 455 KHz (± 2KHz) • VCO Based Modulator(IC XR2206 based) : Carrier Frequency 10 KHz - 200KHz (adjustable) • Mixer / Amplifier : Allows FM input signal to be amplitude modulated by a noise input prior to demodulation, with gain adjustment. • FM Demodulator : 6 nos. • Detuned Resonant Detector ;Quadrature Detector ; Foster-Seeley Detector ; Ratio Detector	5

	• Phase-Locked Loop Detector (IC HEF4046 based) ; Phase-Locked Loop Detector (IC LM565 based) • Low Pass Filter : 3.4 KHz Cut off Frequency Amplifier (with adjustable gain) • Amplitude Limiter : 1 no. ; Switched Faults : 12 nos.; Test Points : 40 nos **Common specs for both the modules:** • Interconnection: 2 mm sockets & Sufficient Nos of 2 mm stackable patch cords • Accessories : Manual CD ,Set of patch cord, Power cord • Cabinet Housing : Enclosed on a plastic box with a cover . • Modules should be on Legend PCB. Housed in a plastic case with cover attached .Inside of cover should contain details/diagrammatic details based on Modulation technique. • Mains Supply : : 110-220 V AC ±10%, 50Hz • No components should be mounted on the top of the Modules (except tuneable coils with protective covering on the top) only block diagram to be provided on the top.	
10.	**Digital Communication Training System** Should have following Modules **a)TDM Pulse Amplitude Modulation & Demodulation Module** • Crystal Frequency (8 MHz or higher), • Four or more Analog Input Channels, • Time Division Multiplexing, Pulse Amplitude Modulation, On Board Analog Signal 500Hz to 4 KHz (Sine wave synchronized to sampling pulse) Adjustable amplitude and separate variable DC level), Sampling Rate : Four sampling signals 32 KHz / 40 KHz / 50 KHz / 80 KHz per channel (switch selectable), • Sampling Pulse with duty cycle variable from 0-90% in decade steps. • Clock Regeneration at Receiver using PLL, Minimum 50 test points **b)TDM Pulse Code Modulation Transmitter Module** • Crystal Frequency : 16 MHz • On Board Analog Signal : 2 KHz, 4 KHz (Sine wave synchronized to sampling pulse Adjustable amplitude and separate variable DC level) • Input Channels : 2 nos.; Multiplexing : Time Division Multiplexing • Modulation : Pulse Code Modulation ; • Sync Signal : Pseudo Random Sync Code Generator • Error Check Code : Off - Odd - Even - Hamming • Operating Mode : Fast : 320 KHz / channel approximately • Slow : 1.9 Hz / channel approximately ; Test Points : 50 nos ; • Minimum 4 Nos of Switched faults for different Error Check Options • Power Supply : 110-220 V, ±10%, 50 Hz **c) TDM Pulse Code demodulation receiver Module** • Should accept two channel Multiplexed data • On Board Low pass Filters , Fast & Slow mode of operation , • On Board PLL for clock regeneration ; On Board Sync code Detector , Error check code options , Odd or even parity -Single bit error detection	5

	; Hamming code single bit error detection & correction , Switched faults for different error check code options • Input Channel : Time Division Multiplexed serial Input • Demodulation : Pulse Code Demodulation • Clock Regeneration : By Phase Locked loop • Error Detection (Single bit) : Off-Odd- Even parity & Hamming code • Error Correction : Hamming code ; Test Points : Minimum 50 nos. **d) Data Formatting and Carrier Mod/Transmitter Module** • On-board Unipolar to Bipolar conversion.& data inverter. • On-board 8-bit Data Source & Clock Source • Data formats : NRZ (L), NRZ (M), RZ, AMI, RB, Biphase(Manchester), Biphase (Mark). • Carrier modulation : ASK, FSK, PSK, DPSK, QPSK • On-board carrier : Sine waves synchronized to transmitted data at 1.6 MHz, 960 KHz, (0 deg. phase) 960 KHz, (90 deg. phase); Test Points : At least 40 Nos ; **e) Data Reformatting and Carrier Demodulation Receiver Module** • On - Board Biphase Clock recovery , data squaring & Differential decoder circuit.On - Board 4th Order Butterworth filters & 8 bit Data Receiver • Input : From Data Formatting and Carrier Modulation/Transmitter Trainer • Data formats: 7 different data reconditioning formats NRZ (M), NRZ(L) ,RZ, AMI, RB, Biphase (Manchester), Biphase (Mark). • Carrier Demodulation : ASK - Rectifier Diode ,FSK PLL Detector PSK /DPSK- Square Loop Detector QPSK -Fourth Power Loop Detector ; Biphase Clock Recovery : By PLL • Test points: At least 35 Nos ; f) **Quadrature Modulation/Demodulation Module (16 QAM)** • Modulation Technique : 16-QAM Modulation with I & Q Channel • Constellation (Vector / XY) View ; Encoding: 4 bits encoding with Symbol Mapper Modulation: • Facility to select step variable clock frequency User Selectable 8 / 16 / 32 / 64 bit Data • On Board Digitally Synthesized Sine & Cosine Wave of Maximum 19.2KHz. • Facility to select Hardware / Real-Time Software Mode With Real-time Software • External Trigger Out should be provided • On board Digitally Synthesized Sine and Cosine wave Generator with Variable Step Frequencies • On board Clock Generator with Step Variable Frequencies (150Hz, 300Hz, 600Hz, 1.2 KHz, 2.4 KHz, 4.8 KHz , 9.6 KHz and 19.2 KHz). • On board Data generator with Step Variable data length (8, 16, 32, 64bits) • Encoding Technique (4 bits encoding with Symbol Mapper, Gray to Binary Encoder) • Modulation Technique (16QAM Modulation with I & Q Channel)	

	• Numerical Control Oscillator (on board NCO for demodulator) • Decoding Techniques (4 bits decoding with Symbol Demapper, Binary to Gray Decoder) • Parallel Port Mode: Standard Port Type **Common specs for all modules:** • Interconnection: 2 mm sockets & Sufficient Nos of 2 mm stackable patch cords • Accessories : Manual in CD ,Set of patch cord, Power cord • Modules should be on Legend PCB. Housed in a plastic case with cover. • Mains Supply : 110-220 V AC ±10%, 50Hz • No components should be mounted on the top of the Modules only block diagram to be provided on the top.	
11.	**To Verify the law of Malus for plane Plane Polarized Light – complete set up using He-Ne Laser.** • Complete Set up Heavy base Optical Bench- Optical Bench-boat type shape, 170 cms Long lathe bed type bench with Vee and Flat ways precise ground for straightness, Four leveling screws with footplates, Scale for determining the position of the carriages graduated every 1 mm, made précised, scale made of brass, fitted on the Bench, • Uprights:Transverse base with vertical motion-LC: 0.1mm……3 Nos. • Fixed base with vertical Motion –LC: 0.1mm……1 No • Spring Lens Holder…….....1 No • Digital Reader with Sensor……....1 No • Polarizer/Analyzer……..1Set • Mount for Sensor……...1 No • He-Ne Laser-2mW with Power Supply……1 set • Plane Light Source set……1 No • Mount for He-Ne laser having Up-down adjustment and fine Motion…….....1 No	1
12.	**Diffraction Experiment – using A He-Ne- Laser** Set up heavy base Optical Bench- Optical Bench-boat type shape, 170 cms Long lathe bed type bench with Vee and Flat ways precise ground for straightness, Four leveling screws with footplates, Scale for determining the position of the carriages graduated every 1 mm, made précised, scale made of brass, fitted on the Bench, Saddles transverse base with Vernier motion LC0.1mm-3 Nos, fixed base with Vernier motion LC0.1mm-1 no, digital reader with sensor, mount lens holder & other accessories using Laser/ He-Ne laser-2mW with power supply and mount for Laser, Magnifier LED & table lamp including He-Ne Laser. Items to be supplied - Heavy base Optical Bench – 1 No. Saddles 4 Nos., Digital Reader with Sensor – 1 No., Laser Mount -1 No. Magnifier LED -1 No, Table Lamp -1 No, He-Ne Laser with Power Supply – 2 mW -1 Set & accessories.	1

13.	**Set up to determine the Specific rotation of Scan Sugar using Polarimeter** Set up having Laurent half shade Polarimeter having polarizer & analyzer, Rotated along a circular scale graduated 0-360 degree with a Vernier reading to 6 min made of brass, provide with Fine motion tangent screw for fine Adjustment. Base having solid casting. Observation tube made of glass size 200mm, screw/cap made of brass, sodium Light source set up made of metal stand with one Slit, transfer & sodium Lamp. Digital balance, testing material, Graduated cylinder plastic good quality 250ml, beaker- glass 500ml, funnel, Pipette, glass rod, thermometer-110 degree Filter paper, table lamp & with Accessories-Observation glass tube, Beaker, Graduated Cylinder-Plastic, Pipette, Funnel, Thermometer -10-110 deg. C & Filter Paper. Items to be supplied - Laurent Half Shade Polarimeter–1 No., Polarimeter Tube – 2 Nos., Sodium Light Source Set -1 No, Sodium Lamp-35W -2 Nos, Graduated Cylinder Plastic-250 ml-1 No, Beaker Glass Borocilicate-500ml-1 no, Funnel-2 Nos, Pipette, 2 Nos Glass Rod-1 no Thermometer – 2Nos & Filter paper-2 pkts	1
14.	**Digital Multimeter (3 1/2 digit) - Display resolution(counts) 6000** • Analog Bargraph Should be Available • Back-Light Should be Available, AC Bandwidth 1 KHz • AC/DC Voltage Range 600 mV to 600 V • AC/DC Current Range 60 µA to 10 A • Resistance Range 600 Ω to 60 MΩ • Capacitance Range 1000 nF to 10 mF • Measurement Category CATIII 600 V • Advance Functions Built-in LED torchlight to illuminate test area, non Contact Voltage Detector with Vsense, continuity alert with flashing backlight for contnuity testing in dim ares and capable of transferring data to PC through IR-USB Cable and Bluetooth adapter	15
15.	**Set up to measure the Numerical Aperture of an Optical fiber Item Required : Optical fibre Kit & Set up for Optical Fiber as a Sensor** Complete Set up having Bread Board top made of Brass and provided with accessories & He-Ne Laser -2mW with power supply. Uprights are having XYZ Transverse, Digital Reader with Sensor, Optical Fiber (10 Meters)-1Set, Mount for laser - 1 no, Screen, Optic Chucks, Microscopic Objective (10x, 20x & 40x) Set, & Mount for He-Ne laser having Up-down adjustment and fine Motion.	1
16.	**Digital Storage Osciloscope- 70MHz or above with bandwidth upgradability feature,** • Two Channel, inbuilt 10 MHz function generator with std. waveforms like Sine, Square, Ramp, • 1GS/s Sampling Rate on all channels, • Memory- 16 kpts or better, • 8-bit Vertical resolution, • waveform update rate- 50,000 wfm/s or better, • Time base range – 5 nsec to 50 sec/division, • Time base accuracy – 50 ppm, • Acquisition Modes - Peak Detect, Average, Normal, Roll Mode, • Measurements - Automatic Measurements, Time & Voltage	20

	Cursors, Math (Add, Subtract, Multiply), FFT. Display - 7 inches or better Color TFT, • Interpolation- Sin x/x, • I/O Interface - USB Ports for USB flash drive support and PC interfacing, • Operating temperature: 0 to +55 °C, • Standard Accessories - 100MHz Passive Probes One per channel, Power Cord, User Manual, Calibration Certificate, • Software for PC connectivity and data logging with 5 year standard warranty	
17.	**Power supply (Triple output)** • A : 0-30 V, 1 A continuously variable by means of Coarse & Fine controls • B : 5 V, 1 A Adjustable from 4 V - 6 V • C : 0 - ± 15 V, 1 A adjustable by means of Coarse & Fine controls • Current Limit : 20 mA - 1 A, Adjustable • Resolution : Voltage : 100 mV ; Current : 10 mA • Recovery Time : ≤ 80 µs • Load Regulation : ± (0.05 %+10 mV) ; Line Regulation : ± (0.05 %+10 mV) • Ripple & Noise : ≤ 1 mVrms • 3-digit display for voltage and 3 ½ digit display for current should be provided. • Over range/ Overload indication by LED for each output should be provided.	30
18.	**Function Generator (10 MHz)** – • Function: Sine, Square, Triangle ,Ramp ,Pulse ,TTL & DC, • Freq. Range : 1 Hz to 10 MHz, Sine; 0.3 Hz - 3 MHz (Square & Triangle), 0.3 Hz to 2 MHz (Ramp, Pulse & TTL), in 7 steps Variable control between steps. • Pulse duty cycle : 15% to 85 % min width 200 ns, • Frequency Range and Mode Selection : Microcontroller based, • Frequency Display : 20 X 4Alpha numeric LCD with backlit, • Output Voltage : 20 Vpp open circuit, 20 & 40 dB (fixed) , 20 dB variable attenuation, Offset Range : ± 5 V DC adjustable, • External Frequency counter: up to 40 MHz, • Modulation: FM, Mod. Frequency: DC-20 KHz, 2 Vpp max. • Accessories: BNC to BNC cable .	20
19.	**8085 Microprocessor trainer kit** • 32K of EPROM / 32 K of RAM . • On Board 8255 PPI – 2 Nos • On Board Three Timer/Counter – 8253 • On Board Graphical LCD 128*64 • On Board USB Interface for PC Interfacing • On Board 16*2 LCD Display • ASCII keyboard • On Board Traffic Light Controller	20

	• On Board Stepper Motor Interface • On Board Digital Output LED- 8 Nos • On Board Digital input –8 Nos • Allows on board Assembly language programming	

Annexure VIII-D

Technical Specification of Items and Equipment required for the Department of Chemistry

1. pH Meter: **Quantity: 10**

pH	
Range	0 to 14
Readability	0.01
Accuracy	± 0.01
Repeatability	± 0.01
EMF (in mV)	
Range	± 1999
Resolution	1
Accuracy	± 0.1% of Range or ±1 counts
Repeatability	± 1
TEMPERATURE	
Range	0 to 100°C
Resolution	0.1 °C
Accuracy	± 0.5°C
Repeatability	± 0.1 °C
Compensation	Manual/Auto
Read out	3½Digit 7 segment LED with polarity indication
Power requirement	230 ± 10%, 50 Hz
SENSOR INTERFACE	
Input Impedance	$>10^{12}$ Ohm @ 25°C
Receptacle	BNC
SLOPE CORRECTION	80 to 120%
Accessories required with instruments	
Stand with holding clamp, Buffer Tablets (ten each of pH 4 and 9), polycarbonate bottles	
Five (5 no) Combination glass pH electrodes	
Any other standard accessory supplied with instrument **(please Specify)**	

2. Digital Conductivity Meter: **Quantity: 10**

Range	0 to 20, 200 µS
	0 to 2, 20 & 200 mS
Readability	0.05 % of Range
Accuracy	± 1% of Range
Repeatability	± 1% of Range
TEMP. COMPENSATION	0 to 50°C Manual
TEMP. CO-EFFICIENT	2%
CELL CONSTANT	0.1, 0.5 or 1.0 (Selectable)
OUTPUT	20 mV Full Scale into 10 kΩ Resistive Impedance.
Power Requirement:	230 ± 10%, 50Hz
Read out	3½ digit LED display
Accessories required with Instrument	
Conductivity Cell Stand with Cell holding Clip	
Five (5 no) Dip Type Conductivity Cell with Cell Constant 1.0± 10%	
Any other standard accessory supplied with instrument **(please Specify)**	

3. Polycarbonate Stand: **Quantity: 100**

- Sturdy and stable polycarbonate; suitable for use with all standard laboratory clamps
- Rust-proof, polycarbonate base has a 46 cm (18") tall, 7.9 mm (5/16") diameter stainless steel support rod secured to the base with two hex nuts
- Offset rod mounts to the 20.8 cm (8-3/16") diameter base, leaving area for larger vessels
- Temperature range plus 135 degree C (275 degree F) to -135 degree C (-211 degree F)
- Autoclave at 121 degree C (250 degree F); ideal for corrosive environments

4. **Pipette Dispenser:**
   (a) Syringe type (capacity 2ml) **Quantity: 30**
   (b) Syringe Type (capacity 10ml) **Quantity: 30**

5. **Bunsen Burner:** **Quantity: 100**
   Superior Quality without stop Cock
   Height : 6” with Round Heavy Base of metal

Annexure VIII-E

Technical Specification for Equipment's of Department of Botany

S.N.	Name of the Items	Required Quantity	Specifications
1	Microscope Electronic	35	Binocular Head: Siedentopf Observation head inclined at 30° rotatable at 360°,Diopter adjustment ring on ocular tube. (±5); Interpupillary distance from 48mm to 75mm, Eyepiece (Anti fungus coated):Wide Field 10X (paired) F.O.V 20mm,Objectives (Anti Mold & Anti fungus coated): S Plan Achromatic 4X,S Plan Achromatic 10X, S Plan Achromatic 40X(S.L.);S Plan Achromatic 100X Oil(S.L.); Mechanical Body:Co-axial focusing system. PRE-FOCUSING LEVER & TENSION ADJUSTMENT RING, Reverse angel quadruple nosepiece revolves on ball bearing; Double plate mechanical stage size 140mm X 132mm having low positioned co-axial controls. Coarse stroke 37.7mm/rotation, fine division 0.002mm, Cross travel 78mm X 54mmmm; Sub Stage Condenser: Abbe condenser N.A.1.25 with adjustable iris diaphragm; Illumination System:The illuminator incorporates 3W LED lamp and has adjustable brightness; Accessories: Dust cover, operating manual, guarantee card, blue filter and Styrofoam molded pack.
2	Water bath	2	Digital Temperature Control, Double Walled, Double Eliment, Max. Temperature Range 100^0C
3	Centrifuge Machine Ultra	1	RPM: 22,000rpm (approx); RCF: 53,029 xg; Max. capacity: 1,000ml x 4; Time: 99hrs 59min 59sec; Display: RPM, RCF, Time, Temperature, Program, Temp.Limit, Accel/Decel, Rotor Number,Rotor Radius; Accel/Decel: 10 step; Temperature: -10 C~ 40 C; Motor: AC Induction Motor; Power supply: 220V, 60Hz, single phase; Dimension: 668W x 801D x 891H/mm (approx)
4	Soil Thermometer	2	Metal Cone, Digital
5	Hot Air Ovens	2	Digital Temperature Control, Fan

6	Hair Dryers	4	High - Low Speed, Hot Warm Cool Temperature
7	pH meter	2	**Manual Type digial pH Meter:** pH Meter is direct reading, two point calibration instrument, reads pH or mV on a digital Red LED display; acidity or alkalinity of solution; Display: Digital LED; Range: pH : 0.00 to 14.00 pH; mV: 0 to ± 1999 mV; Accuracy: ± 0.01 pH, ± 1 mV, ± 1 Count; BNC type for combined pH Electrode in toughen Glass; Stand for Electrode
8	Distillation Unit	2	Double Distiller - 4 Ltrs per hour :Replaceable Quartz Sheathed Heater Built in Triple SafetyGate; Valve: Conserves cooling water wastage; Cooling water monitor; Feeding Water monitor, if water level falls below the heater, the unit switches off; Teflon Stopcock; Quality of Distilled Water: Conductivity (using raw water):0.8 µS/cm Distillate Quality: Pyrogen Free
9	Electric Weighing Balance (0.1 mg)	1	Readability: 0.1 mg; Capacity: Approx 220gm/ 300 gm /600gm;Repeatability: ± 0.1 mg; Tare Range (Subtractive): Full of Capacity; Response Time: =2.5 Sec; Calibration: Built in calibration; Application programs: Tare; Net Total: Counting; Weighing in % formulation; Calculating; Selectable weighing units: Gram and mg; Display: LCD; Provided with Weighing chamber and AC Adaptor.
10	Electric Weighing Balance (1g-2000g)	2	CAPACITY: 1 gm to 2000 gm; ACC : 1 GM; CALIBRATION: Automatic; DISPLAY: Lcd With Back- Light; POWER SUPPLY: Adaptor As Well As Rechargeable Battery.
11	Anemometer	2	Digital
12	Sieve set	1	Set of 8 Sieves, Brass
13	Chart cabinet	2	Iron, Capacity 100 Charts

14	Stage Micrometer	10	0.01 mm
15	Ocular meter	10	0.01 mm
16	Table Lamp	40	With Florecent Light and Megnifier
17	Digital Colorimeter	4	Digital, Detctor, Wavelength 400 - 700 nm, Cuvette, Photometric
18	Burette Stand Plastic	30	Double Burette Clamp, Retort Stand, Weighted Edge
19	Instant Geyser	2	1.5 Liter, Instant
20	Test Tube Stand 25 mm x 150 mm	25	12 Holes
21	Test Tube Stand 18 mm x150 mm	25	12 Holes
22	Test Tube Stand Plastic 25 mm x150 mm	50	24 Holes
23	Shaker Incubator (Orbital Shaker)	1	Speed: 30-250 rpm; Motion:Orbital;Control:Feedback control System; Temperature range: Above Ambient to 60^0 C;Controller:Digital temperature controller PID type; Accuracy:+/- 0.5 ^{0}C; Circulation:Blower assembly for uniform temperature; Sensor: PT 100 Sensor; Tray:Dual tray; Platform size:410mm x 365mm (Universal Flask Holder); Inner Dimension: W x D x H (480 x 425 x 435)mm; Flask Holder 250ml x 16 nos; Operating voltage: 230v ac@ 50 Hrtz

Annexure IX

The Principal,
Deen Dayal Upadhyaya College,
Sector 3, Dwarka,
New Delhi-110078

Deviations from Technical Specifications, and Terms and Conditions of the Tender

S. No.	Tender Document Clause	Technical Specification or terms and conditions in the Tender document	Deviation offered	Reasons and whether deviation adds to the operational efficiency in case of the systems
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Note:

- Above information in detail should be furnished separately for each of the items offered
- Also in case of deviations from any of the terms and conditions of the tender.
- If any deviations from the technical specifications are warranted, reasons for such variations should be specified and
- Whether such variations add to improvement of the overall performance of the systems, if any, should be specifically mentioned and supported by relevant technical documentation as required above.

Signature **Date:**

(Name & Designation)

Annexure IX-A

Commercial Deviations

Bidders Name & Address:

To,
The Principal,
Deen Dayal Upadhyaya College,
Sector 3, Dwarka,
New Delhi-110078

Sub: Commercial Deviations and variations from and exceptions to the specifications

The following are the Commercial Deviations and variations from and exceptions to the specifications and documents for the subject package. These deviations and variations are exhaustive. Except for these deviations, the entire work shall be performed as per your specifications & documents.

Clause	Ref./ Page No.	As specified in the specification	Commercial Deviation and variation to the specification	Withdrawal price in Rs.

(Signature).....

(Printed Name) .
(Designation) .....
(Company Seal).

Date:

Place: