

**DR. SHAKUNTALA MISRA NATIONAL REHABILITATION  
UNIVERSITY  
MOHAAN ROAD, LUCKNOW,  
UTTAR PRADESH – 226017**

**E-TENDER DOCUMENT  
FOR  
SUPPLY, INSTALLATION AND COMMISSIONING IN  
ELECTRONICS AND COMMUNICATION ENGINEERING  
DEPARTMENT.**

**1. NOTICE INVITING E-TENDER**

Dr. Shakuntala Misra National Rehabilitation University (DSMNRU), Lucknow intends to float open E-Tender for the supply of following item(s) as per the details given below:

|                                                |                                                                                                                                                             |
|------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Name of Work</b>                            | Supply, Installation and Commissioning Of Electronics And Communication Engineering Laboratory Instruments For Engineering and Technology, DSMNRU, Lucknow. |
| <b>Estimated Value of the Tender (approx.)</b> | Rs. 9,00,000.00                                                                                                                                             |
| <b>Currency in which payment shall be made</b> | Indian Rupees (INR)                                                                                                                                         |
| <b>Date of Publishing</b>                      | 01 /03 /2021                                                                                                                                                |
| <b>Document Download Starting Date</b>         | 01 /03 /2021                                                                                                                                                |
| <b>Pre-bid Meeting Date</b>                    | To be Informed, if required.<br>Venue: IV <sup>th</sup> Floor, Administrative Block, DSMNRU, Lucknow.                                                       |
| <b>Start Date for uploading of Bids</b>        | 01 /03 /2021                                                                                                                                                |
| <b>Last Date for uploading of Bids</b>         | 15 /03 /2021 TIME 01:00 PM                                                                                                                                  |
| <b>Date of Opening of Technical Bids</b>       | 15 /03/2021 TIME 02:00 PM                                                                                                                                   |
| <b>Date of Opening of Financial Bids</b>       | To be informed later to the technically qualified bidders.                                                                                                  |
| <b>Cost of Tender Document/ Bid</b>            | Rs. 2200.00                                                                                                                                                 |

|                                                        |                                                                                                                                                                               |
|--------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Document Fee</b>                                    |                                                                                                                                                                               |
| <b>Earnest Money Deposit</b>                           | Rs. 9,500.00                                                                                                                                                                  |
| <b>Bid Validity Days</b>                               | 90 days                                                                                                                                                                       |
| <b>Period of Supply</b>                                | 30 days                                                                                                                                                                       |
| <b>On-site Warranty (including annual maintenance)</b> | Three years comprehensive warranty followed by two years comprehensive annual maintenance from the date of successful installation of Instrument.                             |
| <b>Performance Security</b>                            | 5% of the total work order value of the successful bidder. Performance security is required to be submitted within 15 days from the date of issue of Letter of Approval (LoA) |
| <b>Purchaser</b>                                       | Dr. Shakuntala Misra National Rehabilitation University, Mohaan Road, Lucknow (Uttar Pradesh) – 226017                                                                        |
| <b>Place of Delivery</b>                               | Engineering and Technology, Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh)                                                                  |
| <b>e-mail address</b>                                  | <a href="mailto:registrar@dsmnru.ac.in">registrar@dsmnru.ac.in</a>                                                                                                            |

- 1) For participating in the above e-tendering process, the bidder shall have to get them registered in <https://etender.up.nic.in/> and get User I.D. and password.
- 2) All bids (both Technical Bid and Financial Bid) should be uploaded in the e-procurement portal <https://etender.up.nic.in/>. No manual bids will be accepted.
- 3) Bidders are advised to visit Dr. Shakuntala Misra National Rehabilitation University website <http://dsmru.up.nic.in/> for getting the updated information on this tender.

Registrar  
DSMNRU,  
LUCKNOW

## 2. ONLINE SUBMISSION

The online bids (complete in all respect) must be uploaded online as mentioned below:-

Mentioned Below :

| TECHNICAL BID                                           |               |                                                                                                                                                   |             |
|---------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| (Following documents to be provided as single PDF file) |               |                                                                                                                                                   |             |
| Sl. No.                                                 | Documents     | Content                                                                                                                                           | File format |
| 1.                                                      | Technical Bid | Technical Specification Compliance sheet as per                                                                                                   | PDF         |
| 2.                                                      |               | Organisation Declaration sheet as per                                                                                                             | PDF         |
| 3.                                                      |               | List of organisations/ clients where the same products have been supplied (in the last three financial years) along with their contact number(s). | PDF         |
| 4.                                                      |               | Supporting documents in support of all claims made in Annexure                                                                                    | PDF         |
| FINANCIAL BID                                           |               |                                                                                                                                                   |             |
| 1.                                                      | Financial Bid | Price bid should be submitted only in standard Bill of Quantity (BOQ) file provided in the e-tender portal                                        | .xls        |

## 3. INSTRUCTIONS FOR E-TENDERING

### 1. Instructions for online Bid Submission

- Bidders are free to bid for any equipment/item.
- Bid for the product is to be uploaded in two parts i.e. Technical Bid and Financial Bid
- Technical Bids should not contain any commercial/price details. Failure would result in rejection of the bid.
- Only authorized person should sign the tender. Name, designation and address of the authorized person should be mentioned. University may not consider the tender unless and until all the documents are properly signed by the authorized signatory.
- Copy of Power of Attorney for the authorized person shall be uploaded along with the bid.
- All the columns of the tenders shall be duly, properly and exhaustively filled in.

- g) The tenders will be regarded as constituting an offer or offers open to acceptance in whole or in part or parts at the discretion of Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh).
- h) The scanned copies of all the Annexures and required documents must be uploaded with the bids.
- i) All pages of the tender must be duly signed, stamped and submitted. The Tender fee along with DD as EMD drawn in favour of Finance Officer, Dr. Shakuntala Misra National Rehabilitation University, Lucknow in an envelope superscribed as "EMD for Electronics and Communication Engineering Department" along with technical bid in another sealed envelope superscribed as "Technical Bid for Electronics and Communication Engineering Department" together sealed in an envelope superscribed with-Tender for Electronics and Communication Engineering Department in DSMNRU should be sent to the Registrar, Dr. Shakuntala Misra National Rehabilitation University, Mohaan Road, Lucknow-226017 or dropped in the box kept in the Nazarat Section of Admin Block. The bids received after the closing date will not be entertained.

## 2. Minimum Eligibility Criteria/Qualification for Bidding

Following are the minimum criteria/requirements for the bidders participating in the bidding process. (Documents must be provided in support of the following otherwise university may not consider the tender.)

| Sl. No.   | Criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Supporting Documents Required                                                                                                                                                                                                                          |
|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.        | The bidder must be Proprietorship/ Company / Limited Liability Partnership (LLP) registered with statutory authorities for the last three years.                                                                                                                                                                                                                                                                                                                                                                                   | Copy of registration certificate                                                                                                                                                                                                                       |
| 2.<br>(a) | Only Original Equipment Manufacturer (OEM)/ agency of OEM/ authorized dealer having minimum 3 years of experience in execution of laboratory equipments/ instruments supplies should apply against this invitation for bid. In the case of the bidder offering to supply equipments/ instruments under the bid, which the bidder does not manufacture or otherwise produce, the bidder has to provide manufacturer's authorization certificate. Bids submitted without valid authorization certificate will be summarily rejected. | Latest authorization letter from OEM to the bidder authorizing him to do business on OEM's behalf, as associate or authorized business partner for OEM's manufactured items.<br><br>In case of OEM participating as a bidder, power of attorney by the |

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                             |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | <p>Authorization certificate from OEM is essential for all the items of supply under scope of work.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>company's Director to the authorized signatory to be submitted along with the technical bid.</p> <p>Copies of work orders and completion certificates/ satisfactory certificates by various clients in last 3 years.</p> |
| 2.<br>(b) | <p>Any undertaking from the OEM is required stating that they would facilitate the bidder on a regular basis with technology/product updates and extend support for spares and maintenance facilities during warranty and Annual Maintenance Contract (AMC). The bid shall not be considered responsive in absence of the certificate from the OEM</p>                                                                                                                                                                                                                                                                                     | <p>Undertaking by the authorized signatory of OEM in favor of the bidder agency.</p>                                                                                                                                        |
| 3.        | <p>The average annual turnover of the bidder from the laboratory equipment supply quoting for the bid should be Rs. 9,00,000/- (Rupees Nine Lakhs only) during the last last three financial years (2017-2018, 2018-2019, 2019-2020). In this regard, the bidder should submit copies of audited balance sheets including profit and loss accounts for the last three financial years as above. The agency should have profit for all three financial years as above. A registered Chartered Accountant's (CA) certificate indicating laboratory equipment supply turn over amount for the relevant period should also be accompanied.</p> | <p>Certificate from the Chartered Accountant (CA) and copy of audited balance sheets/ profit and loss accounts.</p>                                                                                                         |
| 4.        | <p>The bidder must have successfully executed at least one order of supply of laboratory equipment to Govt./PSU's/Autonomous bodies / Govt. institutions such as IIT's/NIT's/ Central Universities/ State Universities/ Rajkiya Engineering</p>                                                                                                                                                                                                                                                                                                                                                                                            | <p>Copies of work order and completion certificates/satisfactory certificates issued by Govt./PSU's/Autonomous bodies / Govt. institutions such as IIT's/NIT's/ Central</p>                                                 |

|   |                                                                                                                                                                                   |                                                                                                                           |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
|   | Colleges of Uttar Pradesh, etc. during last three financial years for which necessary supporting documents have to be enclosed.                                                   | Universities/ State Universities/ Rajkiya Engineering Colleges of Uttar Pradesh, etc. in last three financial years.      |
| 5 | The bidder should indicate at least four numbers of technically qualified professionals having experience for not less than three years for installation and maintenance support. | List of technically qualified professionals duly self-certificated by the bidder along with the professional certificate. |

Notwithstanding anything stated above, the consignee reserves the right to assess bidder's capability and capacity to perform the contract, should circumstances warrant such an assessment in the overall interest of Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh).

### 3. Digital Signature Certificates

For integrity of data and authenticity/ non-repudiation of electronic records, and to be compliant with IT Act 2000, it is necessary for each user to have a Digital Signature Certificate (DSC) issued by competent certifying authority.

### 4. Registration

For participating in the above e-tendering process, the bidder shall have to get themselves registered on <https://etender.up.nic.in/> and get User ID and password.

### 5. Preparation/Submission of Bids

- a) Bidders are requested to go through the tender advertisement and the tender document carefully to understand the documents required to be submitted as part of the bid. Do note the number of covers in which the bid documents have to be submitted, the number of documents-including the names and content of each of the document that need to be submitted. Any deviations from these may lead to rejection of the bid.
- b) Bidder, in advance, should get ready the bid documents to be submitted as indicated in the tender document/ schedule and generally. Documents can only be in PDF or .xls format as required.
- c) Bidder should log on to the site well in advance for bid submission and complete all formalities of registration so that the bidder uploads the bid on time i.e. on or before the bid submission time.
- d) Bidder should take into account any corrigendum published on the tender document before submitting their bids.
- e) Bidder will be responsible for any delay due to any reason.

### 6. Instruction for Financial Bid/BOQ

- a) Price to be quoted in the Bill of Quantities (BOQ) according to instructions provided.
- b) The bidder can quote for all or any of the laboratory equipments/items listed in this document.
- c) The rate shall be inclusive of all taxes, octroi, transportation (as per the location), packing, loading and unloading (at designated location), insurance, etc. and nothing shall be paid extra except GST as mentioned in BOQ.
- d) The prices quoted by the bidder shall be fixed for the quantity mentioned for the duration of the contract and shall not be subject to adjustment on any account/circumstances. University reserves the right to increase/decrease the quantity.

The changes displayed in the corrigendum/addendum to the bid documents, particularly with the BOQ should be applicable to the bid submission.

## 7. Evaluation of Bids

- a) A committee of Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh) will evaluate the bids of all the bidders, both technically and financially.
- b) Conditional bids shall be summarily rejected.
- c) The technical bids shall be evaluated as per the following:
  - i. Compliance to eligibility criteria: Compliance to the eligibility criteria specified in section "Minimum Eligibility Criteria/Qualification for bidding" of this tender document. Non-compliance of **any** eligibility criteria would result into disqualification of the bid.
  - ii. Compliance to the equipment specifications specified in this tender: The bids found eligible according to the eligibility criteria would then be checked for compliance to the equipment specifications mentioned in the tender document. Non-compliance of any required specifications would result in disqualification of the bid.
- d) The Financial Bids of only the technically qualified bidders would be opened. The date and time of the opening of the financial bids are mentioned in and if there is any change of date and time, the same shall be uploaded on <https://etender.up.nic.in/> and/or <http://dsmru.up.nic.in/>. The bid shall be evaluated on the total value (inclusive of GST and AMC) of the independent item/equipment. The bidder of the lowest commercial bid would be awarded the contract.

Note:

The bid shall be typed in English and signed by the bidder or a person duly authorized to bind the bidder to the contract. The person(s) signing the bids shall initial all pages of the bids.

Wherever any document has been issued in vernacular language, its translated copy (except for Hindi language) in English from the competent authority is also required to be uploaded.

#### 4. INSTRUCTIONS TO BIDDERS

**1. Due date**

The e-tender bid have to be uploaded by the due date. The offers received after the due date and time will not be considered.

**2. Earnest Money Deposit (EMD)**

Details in annexure

**3. Fee**

The Tenderer should submit the cost of tender document, processing fee and EMD Separately through D.D./Banker's Cheque in favour of Finance Officer, DSMNRU, Lucknow

**4. Refund of EMD**

- a) No interest will be paid on EMD amount.
- b) EMD will be returned to unsuccessful Tenderer only after the tender is finalized.
- c) Earnest money will be forfeited if the bidder unilaterally withdraws the offer, or unilaterally amends, impairs or rescinds the offer within the period of its validity.
- d) In case of successful bidder, the EMD shall be refunded after submission of Performance Security from the scheduled bank operating in India.

**5. Acceptance/ Rejection of bids**

DSMNRU reserves the right to reject any or all offers without assigning any reason.

DSMNRU based on the requirement without assigning any reason to the bidder may split work/ scope/ bid offer in stages or in parts according to the need of work for ease of execution of work.

DSMNRU reserves the right to take decision according to requirement and no claim on whatsoever ground shall be entertained from the bidder.

**6. Performance Security**

The successful bidder should be required to deposit **Performance Security** equivalent to 5% cost of the estimated cost of the e-tender to Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh) within 15 days from the date of receipt of Purchase/ Supply Order. The **Performance Security** should be issued by a nationalized/ scheduled bank in favour of "Finance Officer, Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh)" to be valid for a period of 90 days beyond the date of completion of warranty period.

**7. Risk Purchase Clause**

In the event of failure of supply of the item(s)/ equipment(s)/ apparatus(s)/ instrument(s) within the stipulated delivery schedule, the consignee has all the right to purchase the item(s)/ equipment(s)/ apparatus(s)/ instrument(s) from the other source on the risk of the supplier under risk purchase.

## **8. Packing Instructions**

Each package will be marked on three sides with proper paint/ inedible ink, the following:

- a) Item nomenclature
- b) Supply order/contract no.
- c) Suppliers Name and Address
- d) Consignee/ Purchaser details
- e) Packing list reference number

All the packing should be strong enough to withstand rough handling during loading unloading and transporting. Fragile articles should be packed with precaution and should bear the marking like 'Fragile/ Handle with care/this side up, etc.' All delicate surfaces of item(s)/ equipment(s)/ apparatus(s)/ instrument(s) should be carefully protected and painted with protective paint/ compound and wrapped to prevent rusting and damage.

Attachments and spare parts/ goods and small pieces should be packed with adequate protections and wherever possible should send along with the major items. Each item should be tagged so as to identify it with the main equipment and part number and reference number should be indicated.

All protections and threaded fittings should be suitably protected and covers should block the openings.

## **9. Unloading and Unpacking**

Unless specified otherwise in the purchase order, unloading and storage of the same at the designated place should be undertaken by the supplier. The unpacking of the materials should also be arranged by the supplier.

## **10. Delivery and Documents**

Delivery of the goods/ item(s)/ equipment(s)/ apparatus(s)/ instrument(s) should be made within maximum 45 days from the date of the placement of purchase/ supply order. The successful bidder to provide absolute supply schedule within 7days from the receipt of the purchase order. Within 24 hours of the dispatch, the supplier should notify the consignee and the insurance company cable/ telex/ fax/ email the full details of the shipment including contract number, railway receipt number, etc. and date, description of goods, quantity, name of the consignee, invoice, etc. Till the consignee/ purchaser takes over/ receives the goods/ item(s)/ equipment(s)/ apparatus(s)/ instrument(s), the supplier should be responsible to keep the same in safe custody and the charges (if any) to be borne by the supplier. The supplier should provide the following documents to the consignee with a copy to the insurance company:

- a) 4 copies of the supplier invoice contract number, goods description, quantity unit price, total amount;

- b) Acknowledgment of receipt of goods from the consignee(s) by the transporter;
- c) Insurance Certificate (if applicable);
- d) Manufacturer's/Supplier's warranty certificate;
- e) Inspection Certificate issued by the nominated inspection agency, if any;
- f) Supplier's factory inspection report;
- g) Certificate of Origin (if possible by the beneficiary);
- h) Two copies of the packing list identifying the contents of each package.

The above documents should be received by the Consignee before arrival of the Goods (except where the Goods have been delivered directly to the Consignee with all documents) and, if not received, the Supplier will be responsible for any consequent expenses.

#### **11. Delayed Delivery**

If the delivery is not made within the due date for any reason, the Consignee will have the right to impose penalty @ 1% per week and the maximum deduction is 10% of the contract value / price. Once the maximum is reached DSMNRU has the right to terminate the contract/ cancellation of purchase order without any liability to cancellation charges and encash the submitted performance security.

#### **12. Prices**

- a) Prices should be inclusive of charges for delivery of equipment at the sites specified in the scope of work section of this tender document, and are to be quoted in Indian Rupees only.
- b) The prices should be inclusive of current GST, excise duty, freight, insurance, etc. Further if there is any change in the GST by Govt. of India then the same shall be applicable on presentation of the proof. No change due to devaluation of Rupee shall be entertained.
- c) The prices must be quoted in the standard Performa (BOQ) given in Financial Bid failing which the Bid would be treated as unresponsive.

#### **13. Progress of Supply**

Wherever applicable, supplier should regularly intimate progress of supply, in writing, to the consignee as under:

- a) Quantity offered for inspection and date;
- b) Quantity accepted/rejected by inspecting agency and date;
- c) Quantity dispatched/delivered to consignees and date;
- d) Quantity where incidental services have been satisfactorily completed with date;
- e) Quantity where rectification/ repair/ replacement effected/ completed on receipt of any communication from consignee/Consignee with date;
- f) Date of completion of entire Contract including incidental services, if any; and
- g) Date of receipt of entire payments under the Contract (In case of stage-wise inspection, details required should also be specified).

#### **14. Inspection and Tests**

Inspection and tests prior to shipment of Goods and at final acceptance are as follows:

- a) After the goods are manufactured and assembled, inspection and testing of the goods should be carried out at the supplier's plant by the supplier, prior to shipment to check whether the goods are in conformity with the technical specifications attached to the purchase order. Manufacturer's test certificate with data sheet should be issued to this effect and submitted along with the delivery documents. Officer/faculty from the university may inspect the material and testing if required at vendor's premise. The location where the inspection is required to be conducted should be clearly indicated by the bidder after confirmation of the order.
- b) The acceptance test will be conducted by the Consignee/Purchaser, or other such person nominated by the Consignee/Purchaser at its option after the equipment is installed at Purchaser's site in the presence of supplier's representatives. The acceptance will involve trouble free operation and ascertaining conformity with the ordered specifications and quality. There should not be any additional charges for carrying out acceptance test. No malfunction, partial or complete failure of any part of the equipment is expected to occur. The Supplier should maintain necessary log in respect of the result of the test to establish to the entire satisfaction of the Consignee, the successful completion of the test specified.
- c) In the event of the ordered item failing to pass the acceptance test, a period not exceeding one weeks will be given to rectify the defects and clear the acceptance test, failing which the Consignee reserve the right to get the equipment replaced by the Supplier at no extra cost to the Consignee.
- d) Successful conduct and conclusion of the acceptance test for the installed goods and equipment should also be the responsibility and at the cost of the Supplier.
- e) The time taken for pre-dispatch inspection is inclusive of the scheduled completion time of the delivery & installation of the equipment. Only the equipment certified by the Consignee/Purchaser should be dispatched to the consignee.
- f) The Supplier/manufacturer should display sample Item for verification of the equipment by Consignee/ purchaser before technical committee (if required)/ production of the same in bulk if required.

#### **15. Defective Equipment**

- a) If any of the equipment supplied by the Tenderer is found to be substandard, refurbished, un-merchantable or not in accordance with the description/specification or otherwise faulty, the committee will have the right to reject the equipment or its part. The prices of such equipment should be refunded by the Tenderer with 18% interest if such payments for such equipment have already been made.

- b) All damaged or unapproved goods should be returned at suppliers cost and risk and the incidental expenses incurred thereon should be recovered from the supplier. Defective part in equipment, if found before installation and/or during warranty period, should be replaced within 45 days on receipt of the intimation from this office at the cost and risk of supplier including all other charges. In case supplier fails to replace above item as per above terms & conditions Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh) should consider "Banning" the supplier.

#### **16. Right to Use Defective Goods**

- a) If after delivery, acceptance and installation and within the guarantee and warranty period, the operation or use of the goods proves to be unsatisfactory, the Consignee should have the right to continue to operate or use such goods until rectifications of defects, errors or omissions by repair or by partial or complete replacement is made without interfering with the Consignee's operation.
- b) Replacement of Goods broke, damaged or short: In the event of any material or part thereof found broken or damaged or received short during transit or during installation or Commissioning or testing at site, before commissioning in service the suppliers should replace the same free of cost. However, Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh) will recover amount equivalent to the cost of such damaged / broken / short supplied materials and will repay when actual replacement is given.
- c) Substitution and Wrong Supplies: Unauthorized substitution or materials delivered in error of wrong description or quality or supplied in excess quantity or rejected goods should be returned to the supplier at their own cost and risk.

#### **17. Supplier Integrity**

The Supplier is responsible for and obliged to conduct all contracted activities in accordance with the Contract using state of the art methods and economic principles and exercising all means available to achieve the performance specified in the contract.

#### **18. Installation and Demonstration**

The supplier is required to undertake the installation and demonstration of the equipment within 30 days of the arrival of materials at Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh) and site of installation; otherwise the penalty clause will be the same as per the supply of materials. The successful agency has to arrange for technician, other manpower, tools etc for installation and commissioning of the goods supplied by the agency.

In case of any mishappening/ damage to equipment and supplies during the carriage of supplies from the origin of equipment to the installation site, the supplier has to replace it with new equipment/supplies immediately at his own risk. Supplier will settle his claim with the insurance company as per his

convenience. Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh) will not be liable to any type of losses in any form.

#### **19. Training of Personnel**

- a) The Supplier is required to provide training to the designated Consignee's/Purchaser's technical and end user personnel to enable them to effectively operate the total equipment.
- b) The supplier should be required to undertake to provide the technical training to the personnel involved in the use of the equipment at Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh) premises, immediately after completing the installation of the equipment for a minimum period of one week at the supplier's cost.

#### **Insurance**

- a) For delivery of goods at the Purchaser/Consignee premises, the insurance should be obtained by the Supplier in an amount equal to 105% of the value of the goods from "warehouse to warehouse" (final destinations) on "All Risks" basis including War Risks and Strikes. The insurance should be valid for a period of not less than 3 months after installation and commissioning. If orders placed on CIF/CIP basis, the insurance should be up to DSMNRU, Lucknow accordingly.
- b) The Supplier should make all arrangements towards safe and complete delivery at DSMNRU, Lucknow. Such responsibility on part of the supplier will include taking care of insurance, freight, octroi, state level permits etc. as applicable.
- c) The supplier should also take care of transit insurance, comprehensive insurance or any other insurance which have direct bearing on the delivery of the items / equipment at DSMNRU, Lucknow.
- d) It is the total responsibility of supplier to complete all formalities to transit of goods from the place of dispatch to DSMNRU, Lucknow..
- e) The bidder should ensure that no person can engage in the business of a common carrier unless he has granted a certificate of registration to do so for supply of items at DSMNRU, Lucknow.
- f) The transportation of goods through unregistered common carrier is illegal. The bidder should ensure to comply the carriage by latest Road Act and any other relevant.
- g) The supplier will keep DSMNRU, Lucknow informed about various stages of deliveries & installation.

#### **20. Incidental Services**

The incidental services also include:

- a) Furnishing of 01 set of detailed operations & maintenance manual
- b) Arranging the shifting/ moving of the item to their location of final installation within DSMNRU, Lucknow premises at the cost of supplier through their representatives.

## **21. Warranty and Maintenance**

- a) Comprehensive Warranty should be for a minimum period of three (03) years from date of successful installation of goods/ item(s)/ equipment(s)/ apparatus(s)/ instrument(s) at the DSMNRU, Lucknow. The Supplier should, in addition, comply with the performance and/or consumption guarantees specified under the contract. If for reasons attributable to the Supplier, these guarantees are not attained in whole or in part, the Supplier should at its discretion make such changes, modifications, and/or additions to the goods/ item(s)/ equipment(s)/ apparatus(s)/ instrument(s), or any part thereof as shall be necessary in order to attain the contractual guarantees specified in the Contract at its own cost and expense and to carry out further performance tests. The warranty should be comprehensive on site/ DSMNRU, Lucknow. Supplier should give a written information (about the Engineers/technical representative name and cell numbers) before handing over of the goods/ item(s)/ equipment(s)/ apparatus(s)/ instrument(s), to the Consignee and to the end client's nominated representative/s to attend the issues related to the warranty of the goods/ item(s)/ equipment(s)/ apparatus(s)/ instrument(s), supplied under the contract.
- b) The Consignee/Purchaser should promptly notify the Supplier in writing of any claims arising under this warranty. Upon receipt of such notice, the supplier should within 02 days arrange to repair or replace the defective goods or parts thereof free of cost at the ultimate destination. The Supplier should take over the replaced parts/ goods/ item(s)/ equipment(s)/ apparatus(s)/ instrument(s) at the time of their replacement. No claim whatsoever should lie on the Consignee for the replaced parts/ goods/ item(s)/ equipment(s)/ apparatus(s)/ instrument(s) thereafter. The period for correction of defects in the warranty period is 02 days. If the supplier having been notified fails to remedy the defects within 02 days, the consignee/purchaser should proceed to take such remedial action as should be necessary, at the supplier's risk and expenses and without prejudice to any other rights, which the consignee should have against the supplier under the contract.

## **22. Notices**

- a) Any notice given by one party to the other pursuant to this contract/order should be sent to the other party in writing or e mail and confirmed in writing to the other party's address.
- b) A notice should be effective when delivered or on the notice's effective date, whichever is later.
- c) For the purpose of all notices, the following should be the address:  
Registrar, Dr. Shakuntala Misra National Rehabilitation University,  
Mohaan Road, Lucknow, Uttar Pradesh- 226017  
Email: registrar@dsmnru.ac.in

### **23. Taxes**

Suppliers should be entirely responsible for all taxes, duties, license fees, octroi, road permits, etc., incurred until delivery of the contracted Goods to the Consignee.

### **24. Payment**

#### **a) Payment of Laboratory equipment:**

- i. 80% payment shall be made against delivery of Laboratory equipment in good conditions at consignee/purchaser place and to the entire satisfaction of the consignee.
- ii. 10% on successful installation and commissioning of equipment.
- iii. 10% after one month of successful handing over of Laboratory equipment

### **25. User List**

Brochure detailing technical specifications and performance, list of industrial and educational establishments where the items have been supplied must be provided.

### **26. Manuals and Drawings**

- a) Before the goods/ item(s)/ equipment(s)/ apparatus(s)/ instrument(s) are taken over by the Consignee, the Supplier should supply operation and maintenance manuals. These should be in such details as will enable the Consignee to operate, maintain, adjust and repair all parts of the works as stated in the specifications.
- b) The Manuals should be in the ruling language (English) in such form and numbers as stated in the contract.
- c) Unless and otherwise agreed, the goods equipment should not be considered to be completed for the purpose of taking over until such manuals and drawing have been supplied to the Consignee.

### **27. Site Preparation**

- a) The supplier should inform to the Consignee about the site preparation, if any, needed for the installation of equipment, immediately after the receipt of the purchase order. The supplier must provide complete details regarding space and all the other infrastructural requirements needed for the equipment, which the Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh) should arrange before the arrival of the equipment to ensure its timely installation and smooth operation thereafter.
- b) The supplier should visit Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh) and see the site where the equipment is to be installed and should offer his advice and render assistance to Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh) in the preparation of the site and other pre-installation requirements.
- c) Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh) may provide electricity and water for installation of equipment.

## **Spare Parts**

The Supplier should be required to provide any or all of the following materials, notifications, and information pertaining to spare parts manufactured or distributed by the Supplier:

- a) Such spare parts as the Consignee should elect to purchase from the Supplier, providing that this selection should not relieve the Supplier of any warranty obligations under the Contract;
- b) In the event of termination of production of the spare parts: Advance notification to the Consignee of the pending termination, in sufficient time to permit the Consignee to procure needed requirements; and following such termination, furnishing at no cost to the Consignee, the blueprints, drawings and specifications of the spare parts, if requested.
- c) Supplier should carry sufficient inventories to assure ex-stock supply of consumable spares for the Goods, such as gaskets, plugs, washers, belts, connectors, terminals, cables, wires, etc. Other spare parts and components should be supplied as promptly as possible but in any case within six months of placement of order.

### **28. Product Life**

The supplied model of the equipment offered should strictly confirm to the specifications given in the product literature and these models should be supported for a minimum period of 5 years including warranty period. The Models proposed/ marked for withdrawal from the market and the models under quality testing should not be offered. In addition to the above, if any additional/ enhanced configuration is suggested in view of technological changes, it may be furnished as optional feature with/without cost duly explaining the additional utility of the offered model in both the technical offer document as well as Commercial Offer document. However, the basic quote should be confined only to the configuration/ model offered for.

### **29. Termination for Default**

The Consignee should, without prejudice to any other remedy for breach of contract, by written notice of default sent to the Supplier, terminate the Contract in whole or part:

- a) If the Supplier fails to deliver any or all of the Goods within the period(s) specified in the order, or within any extension thereof granted by the Consignee; or
- b) If the Supplier fails to perform any other obligation(s) under the Contract.
- c) If the Supplier, in the judgment of the Consignee has engaged in corrupt or fraudulent practices etc. in competing for or in executing the Contract.
- d) For the purpose of this Clause:
  - **“Corrupt practice”** means the offering, giving, receiving or soliciting of anything of value to influence the action of a public official in the procurement process or in contract execution.

- **“Fraudulent practice”** means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the Borrower, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition.
- In the event the Consignee terminates the Contract in whole or in part, the Consignee should procure, upon such terms and in such manner, as it deems appropriate, Goods or Services similar to those undelivered, and the Supplier should be liable to the Consignee for any excess costs for such similar Goods or Services. However, the Supplier should continue the performance of the Contract to the extent not terminated.

## **Disputes and Jurisdiction**

Resolution of Disputes: The dispute resolution mechanism to be applied pursuant should be as follows:

- a) In case of Dispute or difference arising between the Consignee/purchaser and a bidder /supplier relating to any matter arising out of or connected with this agreement, such disputes or difference should be settled in accordance with the Indian Arbitration & Conciliation Act, 1996, the rules there under and any statutory modifications or re-enactments thereof should apply to the arbitration proceedings.
- b) The dispute should be referred to the Competent Authority, Dr. Shakuntala Misra National Rehabilitation University, Lucknow (Uttar Pradesh) and if he/she is unable or unwilling to act, to the sole arbitration of some other person appointed by him willing to act as such Arbitrator. The award of the arbitrator so appointed should be final, conclusive and binding on all parties to this order.
- c) The venue of the arbitration should be the place from where the order is issued.

### **30. Applicable Law**

The Contract should be interpreted in accordance with the laws of the Union of India. Any legal dispute arising out of any breach of contract pertaining to this tender should be settled in the court of competent jurisdiction located at Lucknow (Uttar Pradesh).

### **31. Compliance Certificate**

This certificate must be provided indicating conformity to the technical specifications.

### **32. Award of Contract**

- a) DSMNRU, Lucknow reserves the right to accept or reject any proposal and to annul the bidding process and reject all proposals at any time prior to award of contract, without thereby incurring any liability to the

Bidders. In case of annulment, all proposals submitted and specifically, proposal securities shall be promptly returned to the Bidder.

- b) DSMNRU, Lucknow has the right to review at any time prior to award of contract that the qualification criteria, as specified in tender document are still being met by the Bidder whose offer has been determined as first rank. A proposal shall be rejected if the qualification criteria, as specified in tender document are no longer met by the Bidder whose offer has been determined as first rank.

### **33. Negotiations**

Normally Negotiations are not allowed. However, if required, negotiations will be held at DSMNRU, Lucknow. Representatives conducting negotiations on behalf of the Bidder must have written authority to negotiate technical, financial and other terms and conclude a legally binding agreement.

### **34. Rates in figures**

- a) Rates Quoted by the Bidder in tender in figures shall be accurately filled.
- b) In the case of any tender where unit rate of any item/items appear unrealistic, such tender will be considered as unbalanced and in case the tender is unable to provide satisfactory explanation such a tender is liable to be disqualified and rejected.

**35.** Any other terms and conditions shall be as per Uttar Pradesh Procurement Manual-2016

### **36. Acknowledgement**

It is hereby acknowledged that we have gone through all the conditions mentioned above and we agree to abide by them.

**Annexure-I**

**TECHNICAL SPECIFICATIONS FOR LABORATORY IN ELECTRONICS  
AND COMMUNICATION ENGINEERING DEPARTMENT**

| S.No. | ITEM DESCRIPTION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Quantity | Unit | Basic Rate in Figures to be entered by Bidders | Total Amount Inclusive of all/GST & Taxes | Total Amount in Words |
|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|------|------------------------------------------------|-------------------------------------------|-----------------------|
| 1     | <b>Digital IC Trainer Kit</b><br>Technical Specifications:<br>Built in Power Supply:<br>DC Power Supply: 5V /1A, $\pm 12V$ , 500 mA<br>0- $\pm 12V$ 150 mA (variable),<br>AC Power Supply: s12-012, 150 mAAC<br>Built in Function Generator:<br>Output Waveform: Sine, Triangle & Square /TTL<br>Output Frequency: 1 Hz to 200 KHz in 6 ranges, with amplitude & frequency control pots. O/P Voltage 20V p-p max.<br>Clock Generator: 10 MHz TTL clock.<br>Input Data Switches and output LED status indicators for High/Low indication (15+1No.)<br>Pulsar switches (2 Nos.) With four debounce outputs- 2 No.<br>Fixed TTL(5V) clocks: 4 Nos. 1KHz, 100Hz, 5Hz, 1Hz<br>Logic probe to detect High/Low level pulses upto 1MHz, with bicolour LEDs to indicate status.<br>2 digit 7 segment display with BCD to 7 segment decoder.<br>LED BAR graph with 10 LED indicator to display 0-2.5V or 0-4V input.<br>Onboard DPM is provided with mode selection.<br>DC volt/current: 200mA/20V – 1No.<br>Onboard POTS: 1K-(1No.) & 1M- (1No.)<br>Onboard speaker: 8 $\Omega$ , 0.5 Watt- (1No.)<br>Built in bread board panel with 1280 tie points and 400distribution points, totaling to 1680 points along with 4mm banana sockets for tapping from the trainer +5V, +12V, GND for the circuits to be assembled on bread board using single stand(#22/24)wire.<br>DIT-I PANEL:<br>IC Used: 7400, 7404, 7408, 7432, 7486, 7476, 7490, 7495, 7402<br>Discrete component used: 10 k x 1, 0.1 $\mu$ F x1 100K Pot.<br>Experiment: Basic logic gates- OR, AND, INVERTER, NOR, NAND, EX-OR, EX-NOR, Boolean<br>Algebra Theorems – 25nos. Kaurnaugh Map, Combinational circuits –Adder, subtractor, code converter like Gray code, 7 seg BCD, Hex, Excess-3, parity checker, Encoder, / Decoder, Multiplexer / Demultiplexer. Sequential Logic circuits like Flip-Flops-R-S, | 4        | EACH |                                                |                                           |                       |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |   |      |  |  |  |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--|--|--|
|   | J-K, T, D. Counters-Async/Sync, decade, ring/twisted, divide by N (modulo N)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |      |  |  |  |
| 2 | <b>30MHz Analog Oscilloscopes</b> <ul style="list-style-type: none"> <li>• Dual Channel, DC to 30 MHz bandwidth</li> <li>• 1 mV/Div, Invert facility in both channels</li> <li>• Time base 0.5 <math>\mu</math>s-0.2 s, x10 magnification to 20 ns/div</li> <li>• Alternate triggering• Active Sync TV Trigger</li> <li>• Component Tester</li> <li>• Continuity Tester</li> <li>• 2 level calibrator</li> <li>• Overscan Indication</li> </ul> <b>Technical Specifications</b> <ul style="list-style-type: none"> <li>• Band with 30MHz</li> <li>• Channels 2 Channels Operating Modes</li> <li>• CH I, CH II separate, CH I &amp; CH II alternate or chopped (Chop. freq. 0.5 MHz approx.)</li> </ul> Addition or difference $\pm$ CH I $\pm$ CH II (with invert switch for both channels) X-Y Mode:<br>Same sensitivity in both directions (CH I as Y & CH II as X)<br><b>Vertical Deflection (Y)</b> <ul style="list-style-type: none"> <li>• Deflection Coefficients: 5mV to 20V/div, 12 Calibrated steps in 1-2-5 sequence.</li> <li>• Bandwidth DC - 30MHz (-3dB)</li> <li>• Rise Time 11.6ns (approx)</li> <li>• Input Impedance 1M<math>\Omega</math>    25pF (approx)</li> <li>• Input Coupling DC - AC - GND</li> <li>• Input Volts (max) 400V (DC +AC peak) (CAT II)</li> <li>• Accuracy <math>\pm</math> 2%</li> </ul> <b>Time Base (T)</b> <ul style="list-style-type: none"> <li>• Time Coefficients :18 calibrated steps 0.5<math>\mu</math>s/div to 0.2s/div in 1-2-5 sequence with variable to 0.2<math>\mu</math>s/div, with x 10 to 20ns/div, LED indication when UNCAL</li> <li>• Accuracy <math>\pm</math> 2% (in cal position) LED indication for 'uncal' position of Time base variable control.</li> <li>• Hold-Off Time Variable control 10:1 (approx)</li> <li>• Sweep Output 5Vpp approx. (Rear Side)</li> </ul> <b>Trigger System</b> <ul style="list-style-type: none"> <li>• Triggering Modes Auto or Normal, LED indication for trigger action</li> <li>• Source CH I, CH II, ALT line, Ext.</li> <li>• Coupling AC, DC</li> <li>• Slope Positive or Negative</li> <li>• TV Sync Active TV Sync separator with TV:V &amp; TV:H values marked on TB Switch</li> <li>• Trigger Bandwidth DC - 60MHz</li> <li>• Sensitivity Internal 0.5div., Ext. 0.5V</li> </ul> <b>Component Tester</b> <ul style="list-style-type: none"> <li>• Test Voltage Approx 8.5 Vrms (open circuit)</li> <li>• Test Current Approx 8 mArms (short circuit)</li> <li>• Test Frequency 50Hz (line frequency)</li> </ul> | 2 | EACH |  |  |  |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |   |      |  |  |  |
|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--|--|--|
|   | <ul style="list-style-type: none"> <li>• Test Connections 2 banana jacks 4 mm dia. One test lead grounded to chassis</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |   |      |  |  |  |
| 3 | <b>50 MHz Digital Storage Oscilloscope</b><br>Technical Specification:<br>Advance Features:<br>Signal bandwidth: 50M z Real-time sampling rate: Max. 500M a/s Equivalent sampling rate: Max. 50Ga/s<br>7.0" TFTLCD Color display<br>32kpts memory depth<br>Independent vertical scale & position control knobs for each channel.<br>Edge, Pulse Width, Video, Slope, Alternate trigger mode<br>Math functions including Add, Subtract, Multiply, Divide & 1024 point FFT 32 parameters of automatic measurements<br>Unique Digital Filter & Waveform recorder function<br>Advanced cursor modes: Manual, Auto & Track<br>Waveform Intensity & Grid Brightness can be adjusted<br>PASS/ FAIL detection, PASS/FAIL output<br>Built-in 50M z hardware frequency counter<br>Save/recall types: Setups, Waveforms, CSV file, Picture | 2 | EACH |  |  |  |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |      |  |  |  |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--|--|--|
| 4 | <b>2 MHz Function Generator</b><br>Advance Features<br>0.2 Hz to 2 MHz Function Generator with Sine, Square, Triangle, Ramp, Pulse, TTL&DC<br>DC offset adjustment<br>Square wave Rise time better than 40ns<br>Microprocessor based design<br>High signal purity and constant amplitude flatness throughout the entire range<br>Internal and External Frequency Modulation<br>Technical Specification<br>Function Generator <ul style="list-style-type: none"> <li>• Operating Modes Sine, Square, Triangle, Ramp and Pulse with Variable Duty Cycle, DC, Free running, internal sweep or external frequency modulation, with or without DC offset</li> <li>• Frequency Range 0.2 Hz to 2 MHz</li> <li>• Frequency Stability &lt; 0.5 % / hr or 0.8 % / 24 hr at constant ambient temperature</li> </ul> Waveform Characteristics<br>Sine wave Distortion 0.2 Hz –100 KHz: max. 0.5 % <ul style="list-style-type: none"> <li>• 0.1 MHz – 0.2 MHz : max. 1.5 %</li> <li>• 0.2 MHz – 2 MHz : max. 3 %</li> </ul> Square Wave Rise time typ. <40 ns <ul style="list-style-type: none"> <li>• Overshoot &lt; 5 %</li> </ul> Triangular non-linearity:<1 % (up to 100 kHz)<br>Trigger Output: Square Wave synchronous to signal output, TTL > 4 Vpp<br>Frequency Display: Accuracy Up to 2 Hz : $\pm (1 \% + 3 D)$<br>2 Hz – 2 MHz : $\pm 5 (5 \times 10 + 1 D)$<br>Output (short-circuit-proof)<br>Output Voltage 10 Vpp into 50 $\Omega$ , max. 20 Vpp open circuit<br>Attenuation max. 60 dB, 2 steps : 20 dB $\pm$ 0.2 dB each, Variable : 0 to 20 dB<br>Amplitude Flatness(sine/triangle) <ul style="list-style-type: none"> <li>• 0.2 Hz – 0.2 MHz: max. 0.2 dB</li> <li>• 0.2 MHz – 2 MHz : max. 0.5 dB</li> </ul> Output Impedance 50 $\Omega$ / 600 $\Omega$<br>DC Offset Variable offset range : max. $\pm 2.5$ V into 50 $\Omega$ max. $\pm 5$ V open circuit<br>FM Input VCF connector on rear panel<br>Frequency Change 1 : 100 approx.<br>Input Impedance 50 k $\Omega$    25 pF<br>Input Voltage $\pm 30$ V max.<br>FM Internal (Sweep)-Sweep Speed 20 ms to 4 s, Sweep Range approx. 1 : 100 | 4 | Each |  |  |  |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--|--|--|

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |    |      |  |  |  |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|------|--|--|--|
| 5 | <b>DC Power Supply</b><br>Main Features <ul style="list-style-type: none"> <li>• Constant Voltage &amp; Constant Current operation</li> <li>• Digital display for voltage &amp; current</li> <li>• Adjustable current limiter</li> <li>• Protection Against over load &amp; short circuit</li> <li>• Compact and light weight</li> </ul> Technical Specifications <ul style="list-style-type: none"> <li>• DC Output: 2 X 0 to 30V /3A Dual Tracking</li> <li>• Switchable Settling Resolution V : 10mV, I : 5mA</li> <li>• Load Regulation <math>\leq \pm (0.05\% + 10\text{mV})</math></li> <li>• Line Regulation <math>\leq \pm (0.05\% + 10\text{mV})</math></li> <li>• Ripple &amp; Noise <math>\leq 1\text{mVrms}</math></li> <li>• Internal Resistance <math>\leq 10\text{m}\Omega</math></li> <li>• Stability <math>\leq 2.5\text{mV}</math> at full load</li> <li>• Recovery Time <math>\leq 50\mu\text{s}</math></li> <li>• Temp. Coefficient <math>\leq \pm (0.05\% + 10\text{mV}/^\circ\text{C})</math></li> <li>• Current Limit adjustment 100mA to max</li> <li>• Display Switchable 3 digit seven segment</li> <li>• LED for Voltage &amp; CurrentDual displayfor voltage current Switchable 3 digit seven segmentLED &amp; Voltage &amp; Current</li> <li>• Display Accuracy V : <math>\pm (1\% + 1 \text{ digit})</math>, I : <math>\pm (1\% + 3 \text{ digit})</math></li> <li>• General Information Built in overheat, Over voltage protections</li> <li>• Insulation Between chassis &amp; output terminal <math>&gt; 10\text{M}\Omega</math> at 100Vdc, chassis &amp; AC plug <math>&gt; 50\text{M}\Omega</math> at 500Vdc</li> <li>• Input Supply 230 AC <math>\pm 10\%</math> / 50-60 Hz (100/120/220/240 available on request)</li> </ul> | 4  |      |  |  |  |
| 6 | <b>4½ Digital Multimeter</b> <ul style="list-style-type: none"> <li>• True RMS</li> <li>• 19999 counts display</li> <li>• Large LCD display</li> <li>• Back light,</li> <li>• Foldable back stand</li> <li>• Technical Specifications</li> </ul> Basic Function Range Accuracy <ul style="list-style-type: none"> <li>• DC Voltage 20mV / 200mV / 2V / 20V / 200V / 1000V <math>\pm (0.05\% + 3\text{D})</math></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 10 | EACH |  |  |  |
| 7 | <b>8085 Microprocessor Trainer Kit</b><br>Technical Specification<br>It should consist of the following Technical Specifications<br>[A] The MAIN UNIT should consist of: -<br>8085 Microprocessor CPU.s<br>MEMORY CAPACITY OF : -<br>4KB SCRATCH PAD RAM,<br>16 KBBATTERY-BACKUP RAM (with onboard Ni-Cd rechargeable Battery), 36KB EPROM Monitor With Advance Software Like One-Pass Line Assembler, Two Pass Assembler & Dis-Assembler, Hex Dump & Basic Interpreter.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1  | EACH |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>ADDITIONAL SERIAL AND PARALLEL I/O: SID/SOD Based.</p> <p>SPEED: 20 MHz crystal operated multi-output clock source to operate various resources on Mother Board like CPU, Baud rate, T/C etc.</p> <p>PARALLEL I/O: 48 I/O lines using two 8255 through 2 No. of 26 pin FRC header.</p> <p>SYSTEM BUS: 50 Pin FRC buffered Bus to connect periware cards as well as to facilitate ROM Emulation of 8 bit/16 bit system memory using external ROM emulation card cum converter card.</p> <p>BATTERY BACKUP: Rechargeable NiCd battery (3.6/60maH) provided to supply power to battery backup memory and Optional RTC 58167.</p> <p>ONBOARD ,8255(2 Nos.), 8259 IC to support 101 keys PC AT keyboard).</p> <p>Should consist of ONBOARD PC/AT KEYBOARD INTERFACE with necessary socket for connecting PC keyboard. One number of 101 Keys PC/AT KEYBOARD to be supplied with each trainer.</p> <p>Should consist of a 20 CHARACTER x 4 LINES Bright, Back-lit L.C.D. (Liquid Crystal Display) DISPLAY with its interface. (Display with adjustable angle position for easy viewing as in case of Lap-tops).</p> <p>Should consists of :-</p> <p>[1] RS232C Serial Interface using 8251 and RS232 driver IC through 9 Pin male D connector.</p> <p>[2] External Loudspeaker (8 Ohm / 3W) interface,</p> <p>1</p> <p>[3] Reset and Single Step/Interrupt push button.</p> <p>[4] EP socket for experiments with Cassette recorder interface.</p> <p>[5] Programmable Wait state generator</p> <p>[6] Onboard Real Time Clock Using IC 58167</p> <p>[7] 11 Nos. fault links for teaching trouble-shooting skills : -</p> <p>Viz. : -</p> <p>[a] Shorts 2 Pins of Address Bus.</p> <p>[b] Shorts 2 Pins of Data Bus.</p> <p>[c] Shorts Address pin to Data bus</p> <p>[d] Increasing Battery Discharge.</p> <p>[e] Disables RD/ &amp; WR/ into BBK RAM</p> <p>[f] Permanent Wait state.</p> <p>[g] Disables 7 Segment Scanning.</p> <p>[h] Disables 7 segment data.</p> <p>[I] Permanent Reset State.</p> <p>[j] Stops 20MHz Clock.</p> <p>[k] Disables Baud Rate Clock.</p> <p>Cross-assembler, Sample Programs &amp; PC Up/Down Loading Software and Sample program &amp; Software should be provided on CD with RS232C Serial Link.</p> |  |  |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |   |      |  |  |  |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--|--|--|
|   | <p>The Unit should be provided in a Rigid Injection Molded Plastic Enclosure with separate manuals for student &amp; Instructor.</p> <p>[B] An SMPS POWER SUPPLY operating on 230V AC, 50Hz, suitable for operation of the above 8085 should be provided along with each trainer set</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |   |      |  |  |  |
| 8 | <p><b>8086 Microprocessor Trainer Kit</b></p> <p>Technical Specification</p> <p>It should consist of the following Technical Specifications</p> <p>[A] The MAIN UNIT should consist of: -</p> <p>8086 Microprocessor CPU.</p> <p>MEMORY CAPACITY OF : -</p> <p>64KB SCRATCH PAD RAM,</p> <p>64 KBBATTERY-BACKUP RAM (with onboard Ni-Cd rechargeable Battery),</p> <p>128 KB EPROM Monitor with Advance Software like Line Assembler, Dis-Assembler, Hex Dump ADDITIONAL SERIAL AND PARALLEL I/O: NA</p> <p>INTERRUPTS: 8 Nos. Using 8259A</p> <p>SPEED: 20 MHz crystal operated multi-output clock source to operate various resources on Mother Board like CPU, Baud rate, T/C etc.</p> <p>PARALLEL I/O: 48 I/O lines using two 8255 through 2 No. of 26 pin FRC header.</p> <p>TIMER COUNTER: 3 Nos. T/C using 8253 pins brought on 6 pin relimate.</p> <p>SYSTEM BUS: 50 Pin FRC buffered Bus to connect periware cards as well as to facilitate ROM</p> <p>Emulation of 8 bit/16 bit system memory using external ROM emulation card cum converter card.</p> <p>BATTERY BACKUP: Rechargeable NiCd battery (3.6/60maH) provided to supply power to battery backup memory and Optional RTC 58167.</p> <p>ONBOARD 8251, 8253, 8255 (2 Nos.), 8259, &amp; IC 89C2051 i.e. (Single chip micro-controller</p> <p>89C2051 IC to support 101 keys PC AT keyboard).</p> <p>Should consist of ONBOARD PC/AT KEYBOARD INTERFACE with necessary socket for connecting PC keyboard. One number of 101 Keys PC/AT KEYBOARD to be supplied with each trainer.</p> <p>Should consist of a 20 CHARACTER x 4 LINES Bright, Back-lit L.C.D. (Liquid Crystal Display)</p> <p>DISPLAY with its interface. (Display with adjustable angle position for easy viewing as in case of Lap-tops).</p> <p>Should consists of :-</p> <p>[1] RS232C Serial Interface using 8251 and RS232 driver IC through 9 Pin male D connector.</p> <p>[2] External Loudspeaker (8 Ohm / 3W) interface,</p> <p>[3] Reset and Single Step/Interrupt push button.</p> <p>[4] EP socket for experiments with Cassette recorder</p> | 1 | EACH |  |  |  |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |        |  |  |  |  |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|--|--|--|--|
|   | <p>interface.</p> <p>[5] Programmable Wait state generator</p> <p>[6] Onboard Real Time Clock Using IC 58167</p> <p>[7] 11 Nos. fault links for teaching trouble-shooting skills : -<br/>Viz. : –</p> <p>[a] Shorts 2 Pins of Address Bus.</p> <p>[b] Shorts 2 Pins of Data Bus.</p> <p>[c] Shorts Address pin to Data bus</p> <p>[d] Increasing Battery Discharge.</p> <p>[e] Disables RD/ &amp; WR/ into BBK RAM</p> <p>[f] Permanent Wait state.</p> <p>[g] Disables 7 Segment Scanning.</p> <p>[h] Disables 7 segment data.</p> <p>[I] Permanent Reset State.</p> <p>[j] Stops 20MHz Clock.</p> <p>[k] Disables Baud Rate Clock.</p> <p>Cross-assembler, Sample Programs &amp; PC Up/Down Loading Software and Sample program &amp; Software should be provided on CD with RS232C Serial Link. The Unit should be provided in a Rigid Injection Moulded Plastic Enclosure with separate manuals for student &amp; Instructor.</p> <p><b>[B} An SMPS POWER SUPPLY operating on 230V AC, 50Hz, suitable for Operation of the above 8086 should be provided along with each trainer set .</b></p>                                                                                                                                        |        |  |  |  |  |
| 9 | <p><b>8051 Microcontroller Trainer Kit</b></p> <p>Technical Specification</p> <p>It should consist of the following Technical Specifications</p> <p>[A] The MAIN UNIT should consist of: -</p> <p>8051 Microcontroller CPU.</p> <p>MEMORY CAPACITY OF : -</p> <p>2KB SCRATCH PAD RAM,</p> <p>16 KBBATTERY-BACKUP RAM (with onboard Ni-Cd rechargeable Battery),</p> <p>36KB EPROM Monitor With Advance Softwares 1 PassLine Assembler, Dis-Assembler,</p> <p>ADDITIONAL SERIAL AND PARALLEL I/O: Using Built in TxD/RxD</p> <p>Unused Pins of P1 Port offered through 10 pin relimate.</p> <p>INTERRUPTS: Built in CPU 8 no. of Ints</p> <p>Optionally I2C Bus Using 24C02 (512X8)EEPROM and Optionally RTCDS1306.</p> <p>SPEED: 20 MHz crystal operated multi-output clock source to operate various resources on Mother Board like CPU, Baud rate, T/C etc.</p> <p>PARALLEL I/O: 48 I/O lines using two 8255 through 2 No. of 26 pin FRC header.</p> <p>TIMER COUNTER: 3 Nos. T/C using 8253 pins brought on 6 pin relimate.</p> <p>SYSTEM BUS: 50 Pin FRC buffered Bus to connect periware cards as well as to facilitate ROM</p> <p>Emulation of 8 bit/16 bit system memory using external ROM emulation card cum converter card.</p> | 2 EACH |  |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>BATTERY BACKUP: Rechargeable NiCd battery (3.6/60maH) provided to supply power to battery backup memory and Optional RTC 58167.</p> <p>ONBOARD 8251, 8253, 8255 (2 Nos.), 8259, &amp; IC 89C2051 i.e. (Single chip micro-controller 89C2051 IC to support 101 keys PC AT keyboard).</p> <p>Should consist of ONBOARD PC/AT KEYBOARD INTERFACE with necessary socket for connecting PC keyboard. One number of 101 Keys PC/AT KEYBOARD to be supplied with each trainer.</p> <p>Should consist of a 20 CHARACTER x 4 LINES Bright, Back-lit L.C.D. (Liquid Crystal Display) DISPLAY with its interface. (Display with adjustable angle position for easy viewing as in case of Lap-tops).</p> <p>Should consists of :-</p> <p>[1] RS232C Serial Interface using 8251 and RS232 driver IC through 9 Pin male D connector.</p> <p>[2] External Loudspeaker (8 Ohm / 3W) interface,</p> <p>[3] Reset and Single Step/Interrupt push button.</p> <p>[4] EP socket for experiments with Cassette recorder interface.</p> <p>[5] Programmable Wait state generator</p> <p>[6] Onboard Real Time Clock Using IC 58167</p> <p>[7] 11 Nos. fault links for teaching trouble-shooting skills : -</p> <p>Viz. : -</p> <p>[a] Shorts 2 Pins of Address Bus.</p> <p>[b] Shorts 2 Pins of Data Bus.</p> <p>[c] Shorts Address pin to Data bus</p> <p>[d] Increasing Battery Discharge.</p> <p>[e] Disables RD/ &amp; WR/ into BBK RAM</p> <p>[f] Permanent Wait state.</p> <p>[g] Disables 7 Segment Scanning.</p> <p>[h] Disables 7 segment data.</p> <p>[I] Permanent Reset State.</p> <p>[j] Stops 20MHz Clock.</p> <p>[k] Disables Baud Rate Clock.</p> <p>Cross-assembler, Sample Programs &amp; PC Up/Down Loading Software and Sample program &amp; Software should be provided on CD with RS232C Serial Link.</p> <p>The Unit should be provided in a Rigid Injection Molded Plastic Enclosure with separate manuals for student &amp; Instructor.</p> <p>Mechanical Details: Aesthetically designed injection molded plastic enclosure of</p> |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |   |      |  |  |  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--|--|--|
| 10 | <b>Interfacing Cards For 8085 &amp; 8086 Microprocessor Kits</b><br>Technical Specification<br>a) 8bit 8 channel SAR ADC (unipolar) DAC (0-5V/+5V).<br>Optional - Digital gain amplifier with built-in L/S interface<br>Electret microphone with preamplifier, light sensor, Analog<br>bar graph (0-5V), voice sampling and replay.<br>b) 8bit 8 channel SAR ADC (unipolar) DAC (0-5V/+5V).<br>Optional - Digital gain amplifier<br>with built-in L/S interface Electret microphone with<br>preamplifier, light sensor, Analog bar<br>graph (0-5V), voice sampling and replay.<br>c) Stepper Motor and 12V DC Motor interface card with<br>motors mounted in it to illustrate<br>Speed & Direction Control.<br>d) Scanning Techniques illustrating 8x8 LED Matrix, 4*4<br>keypad 7 segment 8 digit red LED Display Application board<br>Traffic Light of 2 intersections cum logic study with elevator<br>simulator card with 24 tags and 24 LED's.<br>e) 2 Nos. of Thumbwheel switch (BCD) Module with card<br>with Traffic light of 2 intersections<br>cum logic study card with 24 tags and 24 LED's with optional<br>light sensor (optocoupler) relay<br>f) 8155 Study Card:-It consists of buffers, switches, debounce<br>circuits for software single stepping, one 8155 with tags for all<br>I/O ports, VCC & GND tags, LEDs to display status. bus<br>based application board vcr card application for kit .connects<br>using 50 pin frc cable needs converter card to match of kit 50<br>pin bus with perware control bus . | 2 | EACH |  |  |  |
| 11 | <b>Study Card for 8051 Microcontroller Kit</b><br>Stepper Motor and 12V DC Motor interface card with motors<br>mounted in it to illustrate Speed & Direction Control.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2 | EACH |  |  |  |
| 12 | <b>Communication Systems Trainer (AM &amp; DSB-SC and FM)</b><br>• Aesthetically, designed injection molded desk(Master unit)<br>carrying useful experime<br>resources like power supplies, Multi Function generators,<br>FM/AM/FO Transmitter/receiver,<br>MIC and L/S amplifier, Butteworth Filter (BWF), Sync sine<br>waves etc. while central slot<br>will hold various replaceable experiment panels, Order 10<br>Mus+ 10 panels sets or mu<br>multiples.<br>• Connection through sturdy 4mm Banana sockets, patch<br>cords, ST Connectors., NC<br>Connectors.<br>• Student workbook & instructor's Guide provided.<br>Specifications of Master Unit<br>• Built in DC power Supply:<br>- 5V/1A, = 12V/500mA, 0 to -15V DC (Variable) /100mA,0<br>to 15V DC<br>(Variable)/100mA.<br>• Waveform Generator:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1 | EACH |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>1) Carrier Generator</p> <ul style="list-style-type: none"> <li>- Waveform: SINE/TRG/TTL/CMOS(settable).</li> <li>- Output Frequency: 1 Hz to 1 MHz</li> <li>- Output Voltage:0-20Vpp.</li> <li>- Controls: Frequency &amp; Amplitude control pots.</li> <li>- Modulation: AM (std.)- 1/p volt.=5V,0V-No modulation AM(DSBSC)- 1/p volt. 0-9.8 VPP, volt.0- 2.7, FM I/p volt. 400mV (=50%modulation). ASK-I/p upto 500Hz, =5V Square wave, FSK-I/P upto 500Hz, =4.5V Square wave</li> </ul> <p>2) Audio Oscillator:</p> <ul style="list-style-type: none"> <li>- Waveform: SINE/TRG/SQUARE</li> <li>- Output Frequency:50Hz to 5KHz</li> <li>- Output Voltage: sine 0-2VppSq.0-9Vpp, TRG.0-3pp.</li> <li>- Controls: Freq. &amp; amplitude control pots.</li> </ul> <p>3) Synchronized Sine Wave Generator:</p> <ul style="list-style-type: none"> <li>- Input: 32 KHz TTL /P to Generate 4 nos. of sync. Sine O/P</li> <li>- Waveform: SINE</li> <li>- Output Frequency: 250/500/1000/2000 Hz</li> <li>- Output Voltage:0-10Vpp</li> <li>- Controls: Amplitude control pot</li> <li>- Mic. with Pre Amp. Hand held Electret /dynamic microphone with preamplifier for audio range. Audio Amplifier: Variable Gain upto 20 for Audio range, Built in Loudspeaker-8 ohm/500mW/earphone.</li> <li>- Pink Noise Gen: Frequency response of filter for audio range.</li> <li>- Buffer/AC amplifier: NIV gain amplifier 2 nos., Gain -0 20, For Non sinusoidal Signal Generator cum 1 NV buffer.</li> <li>- BNC TO Banana Converter: Converts 1 BNC Socket to 2 Banana Socket (4mm)&amp; Vice Versa. Butter Worth Filter [LPF]: 4Non-2 pole/4 butter worth filter cutoff freq 3.4 KHz Audio range. Pseudo Random Binary Sequence generator: Switch settable for on/off fix 15 bit PRBS Generator, will also function as input digital data stream generator</li> <li>• Wireless Communication: <ul style="list-style-type: none"> <li>- 1a. FM Transmitter (Transistorized): <ul style="list-style-type: none"> <li>a) Carrier Tunable form 88 MHz to 108 MHz with built in FM[VCD]</li> <li>b) Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</li> <li>c) Tx power O/P: 50to :100mW</li> </ul> </li> <li>- 1b. FM Receiver: External 5 BS5 to connect to antenna, 2ndlf Input,2nd IF Output, speaker &amp;Audio amplifier, AM/FM select switch, L/S impedance 8 ohm/0.5W.</li> <li>- Controls(Manually)Settable 88 to 108 MHz</li> <li>- Antenna/ Transmission: Telescopic antenna [3branch antenna] optional.</li> </ul> </li> </ul> |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <ul style="list-style-type: none"> <li>• 2a. AM Transmitter (Transistorized):</li> <li>- Carrier: 500KHz to 1.5MHz</li> <li>- Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</li> <li>- Tx Power Output: 50 to 100mW.</li> <li>• 2b. AM Receiver: External 5BS5 to connect to antenna, 2nd IF Input, 2nd IF O/P, speaker &amp; Audio amplifier, AM/FM Select switch, L/S impedance 8ohm/o.5W</li> <li>- Controls (Manually): Gain control settable from 0 to 4.5V</li> <li>• 3a. Fiber Optics Transmitter:</li> <li>- Data Input Bandwidth: 500kHz to 1.5MHz.</li> <li>- Modulating Signal: Amplitude-5Vpp. Freq.-Audio Range</li> <li>- Tx Power Output: 50 to 100mW.</li> <li>• 3b. FO Receiver: Detector (tr=8ms) separate BS5 socket for digital, AC coupled &amp; TTL o/ps.</li> <li>- Controls (Manually) bias control.</li> <li>- Antenna / Transmission: 1m plastic fiber cable, CRT-1-492, NA-0.5, -660nm, step index. Terminated with SMA connector.</li> </ul> <p>A) Master Unit: 460mm (W), 160mm(H), 350mm(D)<br/> D) Operating Voltage: 220/240Vac switch settable <math>\pm 10\%</math>, 50Hz/35VA.</p> <p>List of Experiment on Master Unit (9): 1) Voice link using mic. &amp; LS amplifier, 2) Study of AM Xmitter / Receiver, 3) Study of FM Xmitter/Receiver, 4) Band determination of PLL as FM Detector, 5) A) PLL as FM Detector, B) FSK (Frequency Shift Keying) Mod/Demod [Wired] C) FSK (Frequency Shift Keying) MOD/ Demod through [FO] 6) A) Diode as AM Detector b) ASL (Amplitude Shift Keying) Mod/Demod. [Wired] C) ASK (Amplitude Shift Keying Mod Demod [Through FO] 7) Fiber Optics Transmitter/ Receiver 7.1) Analog Bandwidth. 7.2) Digital Bandwidth, 7.3) Voice Communication using mic, speaker &amp; Fiber optics 7.3) Voice Communication using mic, speaker &amp; Fiber optics 7.4) Listening to AM/FM Radio through Fiber link 8) Pseudo Random Binary Sequence Generator {PRBS} 9) Study of active filters, Noise generating &amp; elimination. A) Study of pink Noise Generator B) Study of Signal To Noise Ratio of an Amplifier C) Study of active 2nd &amp; 4th order Low Pass Filter D) Study of Frequency response of HPF / AC Amplifier [3] E) Study of Frequency response of / AC Amplifier [1.6k]</p> <ul style="list-style-type: none"> <li>• AM modulation &amp; demodulation Expt. Panel: (provided with 26 banana) Consisting of 3 Nos. modulators, BPF, envelope-diode- detector, product detector. Built in LPF for standalone application. Switched faults-4 Nos. Modulator: Balanced modulator (DSB)-</li> </ul> |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>2Nos. and DSB-TC-1 NO. SSC-SC-1NO. Demodulator: Envelope detector- 1 No. Product detector-1 No Frequency division multiplexing with 2 Nos. of DSB-SCAM channels (Use P 19 for demod of FDM-AM), 2p LPF for stand alone application List experiments (12): DSB modulation with transmitted carrier(TC). DSB modulation with suppressed ceramic filler (BPF), SSB SC modulation,(for upper/lower side band). DSB TC demodulation, DSB SC demodulation, SSB SC demodulation, ASK Demodulation using synchronous detectro, QAM mod demod, FDM-AM using P19(AM/FM receiver kit), Voice communication, Switched faults. CBT (Optional)-proving theory of AM (DSB-SC, SSB-FDM-QAM) using numerical on pc (Excal Graphs)</p> <ul style="list-style-type: none"> <li>• AM demodulator cum AM-FM Receiver Expt. Panel: (Provided with 3 banana+ 20TPs.) Consisting of antenna, RF amplifier, IF amplifier, Local oscillator (455KHz). Mizer, Audio amplifier with L/S. AM demodulator- Diode Detector for DSB. Switched faults-16 Nos. Synthesized Superheterodyne Receiver- am receiver cum tunner (450 to 1450KHz,) FM receiver cum tunner (88to 108MHz) List of Experiment (8): AM receivr (5): DSB TC demodulation using tuniny of AM receiver, Sensitivity of radio receiver, Signal to noise ratio, Effect of AGC, Fidelity of Radio Receiver, FM receiver(3) FM demod using tuning of FM receiver. Sensitivity of radio receiver, Selecrivity of radio receiver. FDMAM: Using CM6, Frequency Division Multiplexed channel recovery.</li> <li>• FM Modulation &amp; Demodulation Expt. Panel: (provided with 28 banana+3TPs.) Switched faults:-8Nos. Modulator with center freq.455 KHz). Reactance Modulator, Varactor Modulator with center frequency adjustment, phase modulator using varactor, Armstrong Modulator using PLL. Demodulator: Detuned resonant circuit, detector, Quadrature detector, Foster-Seeley discriminators ,Ratio detector, Phase- locket ioop detector &amp; determination of capture and lock range, phase Demodulator using quaadrature detector.2p LPF for standalone application. Pre-emphasis&amp; De emphasis Block for fiat frequency response. List of experiments (12) Frequency modulation using: Reactance modulator, Varactor modulator, phase modulator using varacctor, Frequency demodulation</li> </ul> |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |   |      |  |  |  |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--|--|--|
|    | using Detuned resonant detector, Foster Seeley/ratio detector, Study of PLL capture & lock range & its use as FM detector, Use of PLL as Armstrong Modulator, Quadrature, detector, Phase demodulation using quadrature detector, introduction of noise & its effects on frequency for modulation, Voice communication, pre-emphasis & de-emphasis for fiat frequency response, Switched faults. CBT (Optional)-proving theory of FM, PM (using numerical method on PC(Excel Graphs)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |   |      |  |  |  |
| 13 | <b>Communication Systems Trainer (FM)</b> <ul style="list-style-type: none"> <li>• Aesthetically, designed injection molded desk(Master unit) carrying useful experiment resources like power supplies, Multi Function generators, FM/AM/FO Transmitter/receiver, MIC and L/S amplifier, Butterworth Filter (BWF), Sync sine waves etc. while central slot will hold various replaceable experiment panels, Order 10 Mus+ 10 panels sets or mu multiples.</li> <li>• Connection through sturdy 4mm Banana sockets, patch cords, ST Connectors., NC Connectors.</li> <li>• Student workbook &amp; instructor's Guide provided.</li> </ul> <b>Specifications of Master Unit</b> <ul style="list-style-type: none"> <li>• Built in DC power Supply:             <ul style="list-style-type: none"> <li>- 5V/1A, = 12V/500mA, 0 to -15V DC (Variable) /100mA, 0 to 15V DC (Variable)/100mA.</li> </ul> </li> <li>• Waveform Generator:             <ul style="list-style-type: none"> <li>4) Carrier Generator                 <ul style="list-style-type: none"> <li>- Waveform: SINE/TRG/TTL/CMOS(settable).</li> <li>- Output Frequency: 1 Hz to 1 MHz</li> <li>- Output Voltage: 0-20Vpp.</li> <li>- Controls: Frequency &amp; Amplitude control pots.</li> </ul> </li> <li>- Modulation: AM (std.)- 1/p volt=-5V, 0V-No modulation AM(DSBSC)- 1/p volt. 0-9.8 VPP, volt. 0- 2.7, FM 1/p volt. 400mV (=50%modulation). ASK-1/p upto 500Hz, =5V Square wave, FSK-1/P upto 500Hz, =4.5V Square wave</li> </ul> </li> <li>5) Audio Oscillator:             <ul style="list-style-type: none"> <li>- Waveform: SINE/TRG/SQUARE</li> <li>- Output Frequency: 50Hz to 5KHz</li> <li>- Output Voltage: sine 0-2Vpp Sq. 0-9Vpp, TRG. 0-3pp.</li> <li>- Controls: Freq. &amp; amplitude control pots.</li> </ul> </li> <li>6) Synchronized Sine Wave Generator:             <ul style="list-style-type: none"> <li>- Input: 32 KHz TTL /P to Generate 4 nos. of sync. Sine O/P</li> <li>- Waveform: SINE</li> <li>- Output Frequency: 250/500/1000/2000 Hz</li> <li>- Output Voltage: 0-10Vpp</li> </ul> </li> </ul> | 1 | EACH |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>- Controls: Amplitude control pot</p> <p>- Mic. with Pre Amp. Hand held Electret /dynamic microphone with preamplifier for audio range. Audio Amplifier: Variable Gain upto 20 for Audio range, Built in Loudspeaker-8 ohm/500mW/earphone.</p> <p>- Pink Noise Gen: Frequency response of filter for audio range.</p> <p>- Buffer/AC amplifier: NIV gain amplifier 2 nos., Gain -0 20, For Non sinusoidal Signal Generator cum l NV buffer.</p> <p>- BNC TO Banana Converter: Converts 1 BNC Socket to 2 Banana Socket (4mm)&amp; Vice Versa. Butter Worth Filter [LPF]: 4Non-2 pole/4 butter worth filter cutoff freq 3.4 KHz Audio range. Pseudo Random Binary Sequence generator: Switch settable for on/off fix 15 bit PRBS Generator, will also function as input digital data stream generator</p> <p>• Wireless Communication:</p> <p>- 1a. FM Transmitter (Transistorized):</p> <p>1</p> <p>d) Carrier Tunable form 88 MHz to 108 MHz with built in FM[VCD]</p> <p>e) Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</p> <p>f) Tx power O/P: 50to :100mW</p> <p>- 1b. FM Receiver: External 5 BS5 to connect to antenna, 2ndlf Input,2nd IF Output, speaker &amp;Audio amplifier, AM/FM select switch, L/S impedance 8 ohm/0.5W.</p> <p>- Controls(Manually)Settable 88 to 108 MHz</p> <p>- Antenna/ Transmission: Telescopic antenna [3branch antenna] optional.</p> <p>• 2a.AM Transmitter (Transistorized):</p> <p>- Carrier: 500KHz to 1.5MHz</p> <p>- Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</p> <p>- Tx Power Output:50 to100mW.</p> <p>• 2b. AM Receiver: External 5BS5 to connect to antenna, 2nd IF Input, 2nd IF O/P, speaker &amp;Audio amplifier, AM/FM Select switch, L/S impedance 8ohm/o.5W</p> <p>- Controls(Manually): Gain control settable form 0 to 4.5V</p> <p>• 3a. Fiber Optics Transmitter:</p> <p>- Data Input Bandwidth:500kHz to1.5MHz.</p> <p>- Modulating Signal: Amplitude-5Vpp. Freq-Audio Range</p> <p>- Tx Power Output: 50 to 100mW.</p> <p>• 3b. FO Receiver: Detector (tr=8ms) separate BS5 socket for digital, AC couled &amp;TTL o/ps.</p> <p>- Controls (Manually bias control.</p> <p>- Antenna /Transmission: 1m plastic fiber cable, CRT-1-492,NA-0.5,-660nm,step index. Terminated with SMA connector.</p> |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>H) Operating Voltage:220/240Vac switch settable <math>\pm 10\%</math>, 50Hz/35VA.</p> <p>List of Experiment on Master Unit (9): 1) Voice link using mic.&amp; LS amplifier,2)Study of AM Xmitter / Receiver,3) Study of FM Xmitter/Receiver,4) Band determination of PLL as FM Detector,5) A) PLL as FM Detector, B) FSK (Frequency Shift Keying) Mod/Demod [Wired] C)FSK(Frequency Shift Keying) MOD/ Demod through[FO] 6) A) Diode as AM Detector b) ASL (Amplitude Shift Keying)Mod/Demod. [Wired] C) ASK(Amplitude Shift Keying Mod Demod [ThroughFO] 7) Fiber Optics Transmitter/ Receiver 7.1)Analog Bandwidth. 7.2) Digital Bandwidth, 7.3) Voice Communication using mic, speaker &amp; Fiber optics 7.3) Voice Communication using mic, speaker &amp; Fiber optics 7.4) Listening to AM/FM Radio through Fiber link 8) Pseudo Random Binary Sequence Generator {PRBS} 9) Study of active filters, Noise generating &amp; elimination. A) Study of pink Noise Generator B) Study of Signal To Noise Ratio of an Amplifier C) Study of active 2nd &amp; 4th order Low Pass Filter D) Study of Frequency response of HPF / AC Amplifier [3] E)Study of Frequency response of / AC Amplifier [1.6k]</p> <ul style="list-style-type: none"> <li>• FM Modulation &amp; Demodulation Expt. Panel: (provided with 28 banana+3TPs.)</li> </ul> <p>Switched faults:-8Nos. Modulator with center freq.455 KHz). Reactance Modulator, Varactor Modulator with center frequency adjustment, phase modulator using varactor, Armstrong Modulator using PLL. Demodulator: Detuned resonant circuit, detector, Quadrature detector, Foster-Seeley discriminators ,Ratio detector, Phase- locket ioop detector &amp; determination of capture and lock range, phase Demodulator using quaadrature detector.2p LPF for standatone application. Pre-emphasis&amp; De emphasis Block for fiat frequency response. List of experiments (12) Frequency modulation using: Reactance modulator, Varactor modulator, phase modulator using varacctor, Frequency demodulation using Detuned resonant detectro, Foster Seeley/ratio detector, Study of PLL capture &amp;lock range &amp;its use as FM detector, Use of PLL as Armstrong Modulator, Quaadrature, detector, Phase demodulation using quadrature detector, Introduction of noise &amp;its effects on frequency for modulation, Voice communication, pre-emphasis &amp;de-emphasis for fiat frequency response, Switched faults. CBT (Optional)-proving</p> |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |   |      |  |  |  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--|--|--|
|    | theory of FM,PM (using numerical method on PC (Excel Graphs))                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |   |      |  |  |  |
| 14 | <b>Communication Systems Trainer (PAM, PWM &amp; PPM)</b> <ul style="list-style-type: none"> <li>• Aesthetically, designed injection molded desk(Master unit) carrying useful experiment resources like power supplies, Multi Function generators, FM/AM/FO Transmitter/receiver, MIC and L/S amplifier, Butteworth Filter (BWF), Sync sine waves etc. while central slot will hold various replaceable experiment panels, Order 10 Mus+ 10 panels sets or mu multiples.</li> <li>• Connection through sturdy 4mm Banana sockets, patch cords, ST Connectors., NC Connectors.</li> <li>• Student workbook &amp; instructor's Guide provided.</li> </ul> <b>Specifications of Master Unit</b> <ul style="list-style-type: none"> <li>• Built in DC power Supply: <ul style="list-style-type: none"> <li>- 5V/1A, = 12V/500mA, 0 to -15V DC (Variable) /100mA,0 to 15V DC (Variable)/100mA.</li> </ul> </li> <li>• Waveform Generator: <ol style="list-style-type: none"> <li>7) Carrier Generator <ul style="list-style-type: none"> <li>- Waveform: SINE/TRG/TTL/CMOS(settable).</li> <li>- Output Frequency: 1 Hz to 1 MHz</li> <li>- Output Voltage:0-20Vpp.</li> <li>- Controls: Frequency &amp; Amplitude control pots.</li> <li>- Modulation: AM (std.)- 1/p volt.=5V,0V-No modulation AM(DSBSC)- 1/p volt. 0-9.8 VPP, volt.0- 2.7, FM I/p volt. 400mV (=50%modulation). ASK-I/p upto 500Hz, =5V Square wave, FSK-I/P upto 500Hz, =4.5V Square wave</li> </ul> </li> <li>8) Audio Oscillator: <ul style="list-style-type: none"> <li>- Waveform: SINE/TRG/SQUARE</li> <li>- Output Frequency:50Hz to 5KHz</li> <li>- Output Voltage: sine 0-2VppSq.0-9Vpp, TRG.0-3pp.</li> <li>- Controls: Freq. &amp; amplitude control pots.</li> </ul> </li> <li>9) Synchronized Sine Wave Generator: <ul style="list-style-type: none"> <li>- Input: 32 KHz TTL /P to Generate 4 nos. of sync. Sine O/P</li> <li>- Waveform: SINE</li> <li>- Output Frequency: 250/500/1000/2000 Hz</li> <li>- Output Voltage:0-10Vpp</li> <li>- Controls: Amplitude control pot</li> <li>- Mic. with Pre Amp. Hand held Electret /dynamic microphone with preamplifier for audio range. Audio Amplifier: Variable Gain upto 20 for Audio range, Built in Loudspeaker-8 ohm/500mW/earphone.</li> <li>- Pink Noise Gen: Frequency response of filter for audio range.</li> </ul> </li> </ol></li></ul> | 1 | EACH |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>- Buffer/AC amplifier: NIV gain amplifier 2 nos., Gain -0 20, For Non sinusoidal Signal Generator cum l NV buffer.</p> <p>- BNC TO Banana Converter: Converts 1 BNC Socket to 2 Banana Socket (4mm)&amp; Vice Versa. Butter Worth Filter [LPF]: 4Non-2 pole/4 butter worth filter cutoff freq 3.4 KHz</p> <p>Audio range. Pseudo Random Binary Sequence generator: Switch settable for on/off fix</p> <p>15 bit PRBS Generator, will also function as input digital data stream generator</p> <ul style="list-style-type: none"> <li>• Wireless Communication:</li> </ul> <p>- 1a. FM Transmitter (Transistorized):</p> <p>g) Carrier Tunable form 88 MHz to 108 MHz with built in FM[VCD]</p> <p>h) Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</p> <p>i) Tx power O/P: 50to :100mW</p> <p>- 1b. FM Receiver: External 5 BS5 to connect to antenna, 2ndlf Input,2nd IF Output, speaker &amp;Audio amplifier, AM/FM select switch, L/S impedance 8 ohm/0.5W.</p> <p>- Controls(Manually)Settable 88 to 108 MHz</p> <p>- Antenna/ Transmission: Telescopic antenna [3branch antenna] optional.</p> <ul style="list-style-type: none"> <li>• 2a.AM Transmitter (Transistorized):</li> </ul> <p>- Carrier: 500KHz to 1.5MHz</p> <p>1</p> <p>- Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</p> <p>- Tx Power Output:50 to100mW.</p> <ul style="list-style-type: none"> <li>• 2b. AM Receiver: External 5BS5 to connect to antenna, 2nd IF Input, 2nd IF O/P, speaker &amp;Audio amplifier, AM/FM Select switch, L/S impedance 8ohm/o.5W</li> </ul> <p>- Controls(Manually): Gain control settable form 0 to 4.5V</p> <ul style="list-style-type: none"> <li>• 3a. Fiber Optics Transmitter:</li> </ul> <p>- Data Input Bandwidth:500kHz to1.5MHz.</p> <p>- Modulating Signal: Amplitude-5Vpp. Freq-Audio Range</p> <p>- Tx Power Output: 50 to 100mW.</p> <ul style="list-style-type: none"> <li>• 3b. FO Receiver: Detector (tr=8ms) separate BS5 socket for digital, AC couled &amp;TTL o/ps.</li> </ul> <p>- Controls (Manually) bias control.</p> <p>- Antenna /Transmission: 1m plastic fiber cable, CRT-1-492,NA-0.5,-660nm,step index. Terminated with SMA connector.</p> <p>L) Operating Voltage:220/240Vac switch settable <math>\pm 10\%</math>, 50Hz/35VA.</p> <p>List of Experiment on Master Unit (9): 1) Voice link using mic.&amp; LS amplifier,2)Study of AM Xmitter / Receiver,3) Study of FM Xmitter/Receiver,4) Band determination of PLL as FM Detector,5) A) PLL as FM Detector, B) FSK (Frequency Shift Keying) Mod/Demod [Wired]</p> |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |   |      |  |  |  |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--|--|--|
|    | <p>C)FSK(Frequency Shift Keying) MOD/ Demod through[FO]</p> <p>6) A) Diode as AM Detector b) ASL (Amplitude Shift Keying)Mod/Demod. [Wired] C) ASK(Amplitude Shift Keying Mod Demod [ThroughFO]</p> <p>7) Fiber Optics Transmitter/ Receiver 7.1)Analog Bandwidth. 7.2) Digital Bandwidth, 7.3) Voice Communication using mic, speaker &amp; Fiber optics 7.3) Voice Communication using mic, speaker &amp; Fiber optics 7.4) Listening to AM/FM Radio through Fiber link 8) Pseudo Random Binary Sequence Generator {PRBS} 9) Study of active filters, Noise generating &amp; elimination. A) Study of pink Noise Generator B) Study of Signal To Noise Ratio of an Amplifier C) Study of active 2nd &amp; 4th order Low Pass Filter D) Study of Frequency response of HPF / AC Amplifier [3] E)Study of Frequency response of / AC Amplifier [1.6k]</p> <p>1- Channel Sampling &amp; Reconstruction, 4 channel TDM/PAM, PWM,PWM Expt. Panel (Provided with 20 banana+ 10 TPs+10 Leds)</p> <p>- Crystal Freq-10MHz.</p> <p>- Switched faults:4 Nos.</p> <ul style="list-style-type: none"> <li>• 1 channel Sampling/ Reconstruction &amp; 4 Channel TDM/PAM &amp; demodulation:-</li> </ul> <p>a) Modulator: Analog i/p channel:- 4 Nos, 10Vpp, Bipolar, Settable Sampling Freq. (1of 7): 64 / 32/ 16 /8/4 2/1 KHz With Settable Duty Cycle 10-90% in decade steps.</p> <p>b) De-Modulator: Clock Regeneration PLL, LPF, 1/2/3 Wire Communication.</p> <ul style="list-style-type: none"> <li>• PFM/PPM</li> </ul> <p>a) Modulator: l/p freq. Audio range (Sin)@ 0-8 Vpp, Carrier Freq 64KHz (TRG) @ 8 Vpp O/P TTL.</p> <p>b) De-Modulator: LPF (MU), PPM is converter into PWM then Demodulated.</p> <ul style="list-style-type: none"> <li>• PFM</li> </ul> <p>a) Modulator: Center Freq. (64 KHz/TTL) form Function Generator (MU)is FM modulated by audio singal generating PFM pulse train.</p> <p>b) De Modulator: PLL Detector followed by LPF form MU.</p> <ul style="list-style-type: none"> <li>• List of Experiments(3): Single channel PAM Sampling [1CH Signal Sampling &amp; Reconstruction (1 CH SSRC)] i) Natural Sampling ,ii)Flat Top Sampling (Sample Hold), Multichannel[2CH for SA] PAM Sampling, Multiplexing of data over single wire &amp; Demultiplexing of data at receiver to reconstruct 4 channels by various method 3\2\1 wires [mode 1,2,3 respectively, PWM\PFM\PPM pulse modulation &amp; demodulation as a methods of digital communication</li> </ul> |   |      |  |  |  |
| 15 | <b>Communication Systems Trainer (ASK, PSK, FSK, DPSK, QPSK)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1 | EACH |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <ul style="list-style-type: none"> <li>• Aesthetically, designed injection molded desk(Master unit) carrying useful experiment resources like power supplies, Multi Function generators, FM/AM/FO Transmitter/receiver, MIC and L/S amplifier, Butteworth Filter (BWF), Sync sine waves etc. while central slot will hold various replaceable experiment panels, Order 10 Mus+ 10 panels sets or mu multiples.</li> <li>• Connection through sturdy 4mm Banana sockets, patch cords, ST Connectors., NC Connectors.</li> <li>• Student workbook &amp; instructor's Guide provided.</li> </ul> <p>Specifications of Master Unit</p> <ul style="list-style-type: none"> <li>• Built in DC power Supply: <ul style="list-style-type: none"> <li>- 5V/1A, = 12V/500mA, 0 to -15V DC (Variable) /100mA,0 to 15V DC (Variable)/100mA.</li> </ul> </li> <li>• Waveform Generator: 10) Carrier Generator <ul style="list-style-type: none"> <li>- Waveform: SINE/TRG/TTL/CMOS(settable).</li> <li>- Output Frequency: 1 Hz to 1 MHz</li> <li>- Output Voltage:0-20Vpp.</li> <li>- Controls: Frequency &amp; Amplitude control pots.</li> <li>- Modulation: AM (std.)- 1/p volt-=5V,0V-No modulation AM(DSBSC)- 1/p volt. 0-9.8 VPP, volt.0- 2.7, FM I/p volt. 400mV (=50%modulation). ASK-I/p upto 500Hz, =5V Square wave, FSK-I/P upto 500Hz, =4.5V Square wave</li> </ul> </li> </ul> <p>11) Audio Oscillator:</p> <ul style="list-style-type: none"> <li>- Waveform: SINE/TRG/SQUARE</li> <li>- Output Frequency:50Hz to 5KHz</li> <li>- Output Voltage: sine 0-2VppSq.0-9Vpp, TRG.0-3pp.</li> <li>- Controls: Freq. &amp; amplitude control pots.</li> </ul> <p>12) Synchronized Sine Wave Generator:</p> <ul style="list-style-type: none"> <li>- Input: 32 KHz TTL /P to Generate 4 nos. of sync. Sine O/P</li> <li>- Waveform: SINE</li> <li>- Output Frequency: 250/500/1000/2000 Hz</li> <li>- Output Voltage:0-10Vpp</li> <li>- Controls: Amplitude control pot</li> <li>- Mic. with Pre Amp. Hand held Electret /dynamic microphone with preamplifier for audio range. Audio Amplifier: Variable Gain upto 20 for Audio range, Built in Loudspeaker-8 ohm/500mW/earphone.</li> <li>- Pink Noise Gen: Frequency response of filter for audio range.</li> <li>- Buffer/AC amplifier: NIV gain amplifier 2 nos., Gain -0 20, For Non sinusoidal Signal Generator cum l NV buffer.</li> <li>- BNC TO Banana Converter: Converts 1 BNC Socket to 2 Banana Socket (4mm)&amp; Vice Versa. Butter Worth Filter [LPF]: 4Non-2 pole/4 butter worth</li> </ul> |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>filter cutoff freq 3.4 KHz</p> <p>Audio range. Pseudo Random Binary Sequence generator: Switch settable for on/off fix</p> <p>15 bit PRBS Generator, will also function as input digital data stream generator</p> <ul style="list-style-type: none"> <li>• Wireless Communication: <ul style="list-style-type: none"> <li>- 1a. FM Transmitter (Transistorized): <ul style="list-style-type: none"> <li>j) Carrier Tunable form 88 MHz to 108 MHz with built in FM[VCD]</li> <li>k) Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</li> <li>l) Tx power O/P: 50to :100mW</li> </ul> </li> <li>- 1b. FM Receiver: External 5 BS5 to connect to antenna, 2ndlf Input,2nd IF Output, speaker &amp;Audio amplifier, AM/FM select switch, L/S impedance 8 ohm/0.5W.</li> <li>- Controls(Manually)Settable 88 to 108 MHz</li> <li>- Antenna/ Transmission: Telescopic antenna [3branch antenna] optional.</li> </ul> </li> <li>• 2a.AM Transmitter (Transistorized): <ul style="list-style-type: none"> <li>- Carrier: 500KHz to 1.5MHz</li> <li>- Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</li> <li>- Tx Power Output:50 to100mW.</li> </ul> </li> <li>• 2b. AM Receiver: External 5BS5 to connect to antenna, 2nd IF Input, 2nd IF O/P, speaker &amp;Audio amplifier, AM/FM Select switch, L/S impedance 8ohm/o.5W</li> <li>- Controls(Manually): Gain control settable form 0 to 4.5V</li> <li>• 3a. Fiber Optics Transmitter: <ul style="list-style-type: none"> <li>- Data Input Bandwidth:500kHz to1.5MHz.</li> <li>- Modulating Signal: Amplitude-5Vpp. Freq-Audio Range</li> <li>- Tx Power Output: 50 to 100mW.</li> </ul> </li> <li>• 3b. FO Receiver: Detector (<math>t_r=8ms</math>) separate BS5 socket for digital, AC couled &amp;TTL o/ps.</li> <li>- Controls (Manually bias control.</li> <li>- Antenna /Transmission: 1m plastic fiber cable, CRT-1-492,NA-0.5,-660nm,step index. Terminated with SMA connector.</li> </ul> <p>P) Operating Voltage:220/240Vac switch settable <math>\pm 10\%</math>, 50Hz/35VA.</p> <p>List of Experiment on Master Unit (9): 1) Voice link using mic.&amp; LS amplifier,2)Study of AM Xmitter / Receiver,3) Study of FM Xmitter/Receiver,4) Band determination of PLL as FM Detector,5) A) PLL as FM Detector, B) FSK (Frequency Shift Keying) Mod/Demod [Wired] C)FSK(Frequency Shift Keying) MOD/ Demod through[FO]</p> <p>6) A) Diode as AM Detector b) ASL (Amplitude Shift Keying)Mod/Demod. [Wired] C) ASK(Amplitude Shift Keying Mod Demod [Through FO]</p> <p>7) Fiber Optics Transmitter/ Receiver 7.1)Analog Bandwidth. 7.2) Digital Bandwidth, 7.3) Voice Communication using mic, speaker &amp; Fiber optics 7.3) Voice</p> |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |   |      |  |  |  |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--|--|--|
|    | <p>Communication using mic, speaker &amp; Fiber optics 7.4) Listening to AM/FM Radio through Fiber link 8) Pseudo Random Binary Sequence Generator {PRBS} 9) Study of active filters, Noise generating &amp; elimination. A) Study of pink Noise Generator B) Study of Signal To Noise Ratio of an Amplifier C) Study of active 2nd &amp; 4th order Low Pass Filter D) Study of Frequency response of HPF / AC Amplifier [3] E) Study of Frequency response of / AC Amplifier [1.6k] Integrated DigiCom Expt. Panel: [PSK, QPSK, 16 QAM, 8 QAM, 8 PSK, MSK differential mode &amp; non- differential mode] (Provided with 12 banana + 2 TPs + 12 LED + 5 switch)</p> <ul style="list-style-type: none"> <li>On-board Clock source @5MHz.</li> </ul> <p>a) Mod/Demod Function Block:- Onboard adjustable DC signal source(+5vpp) .7 Bit ADC with Sampling Frequency of 6.5 KHz, 4Bit selectable digital 1/p,s using switch, Sine Adder, Sine Divider, Differentiator Block, Scheme selector block, Frequency selector block, Quadrature sine generator 1,Q @208-416KHz, MUX 2:1, Latch, PISO, SIPO(1:2:1:3:1:4) on board 208 KHz, TTL reference clock, Delayed clock for cycle slip error. 7 Bit Dac with single Analog Output- 10Vpp &amp; Audio upto 1.3KHz [2KHz can be tolerated], 7Bit Amplitude &amp; Phase comparator, Socket selectable DAC O/P either one of the Modulation O/P or Demodulation O/P, with differential or one differential mode and recovered signal by passing through 4p Butterworth filter on NGLPF Panel (MU). List of experiments (6): Generate PSK, QPSK, 16 QAM, 8 QAM, 8 psk, MSK modulated digitized sin output in- differential &amp; non-differential mode, Verify variations in phase and frequency [if any], Depending upon modulation bits, Draw constellation diagram for PSK, QPSK, 16 QAM, 8 QAM, 8PSK, Demod verification in-differential &amp; differential mode for all schemes, Determine upper limit of data rate given a particular carrier frequency, Send and receive voice using PSK, QPSK, 16 QAM, 8 QAM, 8PSK, MSK, Cycle slip error in 8psk &amp; 8QAM, Bit Error Ratio (BER).</p> |   |      |  |  |  |
| 16 | <p><b>Communication Systems Trainer (Analog Signal, Sampling and Reconstruction)</b></p> <ul style="list-style-type: none"> <li>Aesthetically, designed injection molded desk (Master unit) carrying useful experiment resources like power supplies, Multi Function generators, FM/AM/FO Transmitter/receiver,</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1 | EACH |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>MIC and L/S amplifier, Butterworth Filter (BWF), Sync sine waves etc. while central slot</p> <p>1</p> <p>will hold various replaceable experiment panels, Order 10 Mus+ 10 panels sets or mu multiples.</p> <ul style="list-style-type: none"> <li>• Connection through sturdy 4mm Banana sockets, patch cords, ST Connectors., NC Connectors.</li> <li>• Student workbook &amp; instructor's Guide provided.</li> </ul> <p>Specifications of Master Unit</p> <ul style="list-style-type: none"> <li>• Built in DC power Supply:<br/>- 5V/1A, = 12V/500mA, 0 to -15V DC (Variable) /100mA,0 to 15V DC (Variable)/100mA.</li> <li>• Waveform Generator:</li> </ul> <p>13) Carrier Generator</p> <ul style="list-style-type: none"> <li>- Waveform: SINE/TRG/TTL/CMOS(settable).</li> <li>- Output Frequency: 1 Hz to 1 MHz</li> <li>- Output Voltage:0-20Vpp.</li> <li>- Controls: Frequency &amp; Amplitude control pots.</li> <li>- Modulation: AM (std.)- 1/p volt-=5V,0V-No modulation AM(DSBSC)- 1/p volt. 0-9.8 VPP, volt.0- 2.7, FM I/p volt. 400mV (=50%modulation). ASK-I/p upto 500Hz, =5V Square wave, FSK-I/P upto 500Hz, =4.5V Square wave</li> </ul> <p>14) Audio Oscillator:</p> <ul style="list-style-type: none"> <li>- Waveform: SINE/TRG/SQUARE</li> <li>- Output Frequency:50Hz to 5KHz</li> <li>- Output Voltage: sine 0-2VppSq.0-9Vpp, TRG.0-3pp.</li> <li>- Controls: Freq. &amp; amplitude control pots.</li> </ul> <p>15) Synchronized Sine Wave Generator:</p> <ul style="list-style-type: none"> <li>- Input: 32 KHz TTL /P to Generate 4 nos. of sync. Sine O/P</li> <li>- Waveform: SINE</li> <li>- Output Frequency: 250/500/1000/2000 Hz</li> <li>- Output Voltage:0-10Vpp</li> <li>- Controls: Amplitude control pot</li> <li>- Mic. with Pre Amp. Hand held Electret /dynamic microphone with preamplifier for audio range. Audio Amplifier: Variable Gain upto 20 for Audio range, Built in Loudspeaker-8 ohm/500mW/earphone.</li> <li>- Pink Noise Gen: Frequency response of filter for audio range.</li> <li>- Buffer/AC amplifier: NIV gain amplifier 2 nos., Gain -0 20, For Non sinusoidal Signal Generator cum 1 NV buffer.</li> <li>- BNC TO Banana Converter: Converts 1 BNC Socket to 2 Banana Socket (4mm)&amp; Vice Versa. Butter Worth Filter [LPF]: 4Non-2 pole/4 butter worth filter cutoff freq 3.4 KHz</li> <li>Audio range. Pseudo Random Binary Sequence generator:</li> </ul> |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>Switch settable for on/off fix</p> <p>15 bit PRBS Generator, will also function as input digital data stream generator</p> <ul style="list-style-type: none"> <li>• Wireless Communication:</li> <li>- 1a. FM Transmitter (Transistorized):</li> <li>m) Carrier Tunable form 88 MHz to 108 MHz with built in FM[VCD]</li> <li>n) Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</li> <li>o) Tx power O/P: 50to :100mW</li> <li>- 1b. FM Receiver: External 5 BS5 to connect to antenna, 2ndlf Input,2nd IF Output, speaker &amp;Audio amplifier, AM/FM select switch, L/S impedance 8 ohm/0.5W.</li> <li>- Controls(Manually)Settable 88 to 108 MHz</li> <li>- Antenna/ Transmission: Telescopic antenna [3branch antenna] optional.</li> <li>• 2a.AM Transmitter (Transistorized):</li> <li>- Carrier: 500KHz to 1.5MHz</li> <li>- Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</li> <li>- Tx Power Output:50 to100mW.</li> <li>• 2b. AM Receiver: External 5BS5 to connect to antenna, 2nd IF Input, 2nd IF O/P, speaker &amp;Audio amplifier, AM/FM Select switch, L/S impedance 8ohm/o.5W</li> <li>- Controls(Manually): Gain control settable form 0 to 4.5V</li> <li>• 3a. Fiber Optics Transmitter:</li> <li>- Data Input Bandwidth:500kHz to1.5MHz.</li> <li>- Modulating Signal: Amplitude-5Vpp. Freq-Audio Range</li> <li>- Tx Power Output: 50 to 100mW.</li> <li>• 3b. FO Receiver: Detector (tr=8ms) separate BS5 socket for digital, AC couled &amp;TTL o/ps.</li> <li>- Controls (Manually bias control.</li> <li>- Antenna /Transmission: 1m plastic fiber cable, CRT-1-492,NA-0.5,-660nm,step index. Terminated with SMA connector.</li> <li>T) Operating Voltage:220/240Vac switch settable <math>\pm 10\%</math>, 50Hz/35VA.</li> <li>List of Experiment on Master Unit (9): 1) Voice link using mic.&amp; LS amplifier,2)Study of AM Xmitter / Receiver,3) Study of FM Xmitter/Receiver,4) Band determination of PLL as FM Detector,5) A) PLL as FM Detector, B) FSK (Frequency Shift Keying) Mod/Demod [Wired] C)FSK(Frequency Shift Keying) MOD/ Demod through[FO]</li> <li>6) A) Diode as AM Detector b) ASL (Amplitude Shift Keying)Mod/Demod. [Wired] C) ASK(Amplitude Shift Keying Mod Demod [ThroughFO]</li> <li>7) Fiber Optics Transmitter/ Receiver 7.1)Analog Bandwidth. 7.2) Digital Bandwidth, 7.3) Voice Communication using mic, speaker &amp; Fiber optics 7.3) Voice Communication using mic, speaker &amp; Fiber optics 7.4) Listening to AM/FM Radio through Fiber</li> </ul> |  |  |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |   |      |  |  |  |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--|--|--|
|    | <p>link 8) Pseudo Random Binary Sequence Generator {PRBS} 9) Study of active filters, Noise generating &amp; elimination. A) Study of pink Noise Generator B) Study of Signal To Noise Ratio of an Amplifier C) Study of active 2nd &amp; 4th order Low Pass Filter D) Study of Frequency response of HPF / AC Amplifier [3] E) Study of Frequency response of / AC Amplifier [1.6k] Channel Sampling &amp; Reconstruction, 4 channel TDM/PAM, PWM, PWM Expt. Panel (Provided with 20 banana+ 10 TPs+10 Leds)</p> <ul style="list-style-type: none"> <li>- Crystal Freq-10MHz.</li> <li>- Switched faults:4 Nos.</li> <li>• 1 channel Sampling/ Reconstruction &amp; 4 Channel TDM/PAM &amp; demodulation:-</li> <li>c) Modulator: Analog i/p channel:- 4 Nos, 10Vpp, Bipolar, Settable Sampling Freq. (1 of 7): 64 / 32/ 16 / 8/ 4 2/ 1 KHz With Settable Duty Cycle 10-90% in decade steps.</li> <li>d) De-Modulator: Clock Regeneration PLL, LPF, 1/2/3 Wire Communication.</li> <li>• PFM/PPM</li> <li>c) Modulator: l/p freq. Audio range (Sin)@ 0-8 Vpp, Carrier Freq 64KHz (TRG) @ 8 Vpp O/P TTL.</li> <li>d) De-Modulator: LPF (MU), PPM is converter into PWM then Demodulated.</li> <li>• PFM</li> <li>c) Modulator: Center Freq. (64 KHz/TTL) form Function Generator (MU) is FM modulated by audiosignal generating PFM pulse train.</li> <li>d) De Modulator: PLL Detector followed by LPF form MU.</li> <li>• List of Experiments(3): Single channel PAM Sampling [1CH Signal Sampling &amp; Reconstruction (1 CH SSRC)] i) Natural Sampling, ii) Flat Top Sampling (Sample Hold), Multichannel [2CH for SA] PAM Sampling, Multiplexing of data over single wire &amp; Demultiplexing of data at receiver to reconstruct 4 channels by various method 3/2/1 wires [mode 1,2,3 respectively, PWM\PFM\PPM pulse modulation &amp; demodulation as a methods of digital communication</li> </ul> |   |      |  |  |  |
| 17 | <p><b>Communication Systems Trainer (PCM)</b></p> <ul style="list-style-type: none"> <li>• Aesthetically, designed injection molded desk (Master unit) carrying useful experiment resources like power supplies, Multi Function generators, FM/AM/FO Transmitter/receiver, MIC and L/S amplifier, Butterworth Filter (BWF), Sync sine waves etc. while central slot will hold various replaceable experiment panels, Order 10 Mus+ 10 panels sets or multiples.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 1 | EACH |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <ul style="list-style-type: none"> <li>• Connection through sturdy 4mm Banana sockets, patch cords, ST Connectors., NC Connectors.</li> <li>• Student workbook &amp; instructor's Guide provided.</li> </ul> <p>Specifications of Master Unit</p> <ul style="list-style-type: none"> <li>• Built in DC power Supply: <ul style="list-style-type: none"> <li>- 5V/1A, = 12V/500mA, 0 to -15V DC (Variable) /100mA,0 to 15V DC (Variable)/100mA.</li> </ul> </li> <li>• Waveform Generator: <ol style="list-style-type: none"> <li>16) Carrier Generator <ul style="list-style-type: none"> <li>- Waveform: SINE/TRG/TTL/CMOS(settable).</li> <li>- Output Frequency: 1 Hz to 1 MHz</li> <li>- Output Voltage:0-20Vpp.</li> <li>- Controls: Frequency &amp; Amplitude control pots.</li> <li>- Modulation: AM (std.)- 1/p volt-=5V,0V-No modulation AM(DSBSC)- 1/p volt. 0-9.8 VPP, volt.0- 2.7, FM I/p volt. 400mV (=50%modulation). ASK-I/p upto 500Hz, =5V Square wave, FSK-I/P upto 500Hz, =4.5V Square wave</li> </ul> </li> <li>17) Audio Oscillator: <ul style="list-style-type: none"> <li>- Waveform: SINE/TRG/SQUARE</li> <li>- Output Frequency:50Hz to 5KHz</li> <li>- Output Voltage: sine 0-2VppSq.0-9Vpp, TRG.0-3pp.</li> <li>- Controls: Freq. &amp; amplitude control pots.</li> </ul> </li> <li>18) Synchronized Sine Wave Generator: <ul style="list-style-type: none"> <li>- Input: 32 KHz TTL /P to Generate 4 nos. of sync. Sine O/P</li> <li>- Waveform: SINE</li> <li>- Output Frequency: 250/500/1000/2000 Hz</li> <li>- Output Voltage:0-10Vpp</li> <li>- Controls: Amplitude control pot</li> <li>- Mic. with Pre Amp. Hand held Electret /dynamic microphone with preamplifier for audio range. Audio Amplifier: Variable Gain upto 20 for Audio range, Built in Loudspeaker-8 ohm/500mW/earphone.</li> <li>- Pink Noise Gen: Frequency response of filter for audio range.</li> <li>- Buffer/AC amplifier: NIV gain amplifier 2 nos., Gain -0 20, For Non sinusoidal Signal Generator cum l NV buffer.</li> <li>- BNC TO Banana Converter: Converts 1 BNC Socket to 2 Banana Socket (4mm)&amp; Vice Versa. Butter Worth Filter [LPF]: 4Non-2 pole/4 butter worth filter cutoff freq 3.4 KHz</li> <li>Audio range. Pseudo Random Binary Sequence generator: Switch settable for on/off fix</li> <li>15 bit PRBS Generator, will also function as input digital data stream generator</li> </ul> </li> <li>• Wireless Communication: <ul style="list-style-type: none"> <li>- 1a. FM Transmitter (Transistorized):</li> </ul> </li> </ol></li></ul> |  |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>p) Carrier Tunable form 88 MHz to 108 MHz with built in FM[VCD]</p> <p>q) Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</p> <p>r) Tx power O/P: 50to :100mW</p> <p>- 1b. FM Receiver: External 5 BS5 to connect to antenna, 2ndlf Input,2nd IF Output, speaker &amp;Audio amplifier, AM/FM select switch, L/S impedance 8 ohm/0.5W.</p> <p>- Controls(Manually)Settable 88 to 108 MHz</p> <p>- Antenna/ Transmission: Telescopic antenna [3branch antenna] optional.</p> <p>• 2a.AM Transmitter (Transistorized):</p> <p>- Carrier: 500KHz to 1.5MHz</p> <p>- Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</p> <p>- Tx Power Output:50 to100mW.</p> <p>• 2b. AM Receiver: External 5BS5 to connect to antenna, 2nd IF Input, 2nd IF O/P, speaker &amp;Audio amplifier, AM/FM Select switch, L/S impedance 8ohm/o.5W</p> <p>- Controls(Manually): Gain control settable form 0 to 4.5V</p> <p>• 3a. Fiber Optics Transmitter:</p> <p>- Data Input Bandwidth:500kHz to1.5MHz.</p> <p>- Modulating Signal: Amplitude-5Vpp. Freq-Audio Range</p> <p>- Tx Power Output: 50 to 100mW.</p> <p>• 3b. FO Receiver: Detector (tr=8ms) separate BS5 socket for digital, AC couled &amp;TTL o/ps.</p> <p>- Controls (Manually bias control.</p> <p>- Antenna /Transmission: 1m plastic fiber cable, CRT-1-492,NA-0.5,-660nm,step index. Terminated with SMA connector.</p> <p>X) Operating Voltage:220/240Vac switch settable <math>\pm 10\%</math>, 50Hz/35VA.</p> <p>List of Experiment on Master Unit (9): 1) Voice link using mic.&amp; LS amplifier,2)Study of AM Xmitter / Receiver,3) Study of FM Xmitter/Receiver,4) Band determination of PLL as FM Detector,5) A) PLL as FM Detector, B) FSK (Frequency Shift Keying) Mod/Demod [Wired] C)FSK(Frequency Shift Keying) MOD/ Demod through[FO]</p> <p>6) A) Diode as AM Detector b) ASL (Amplitude Shift Keying)Mod/Demod. [Wired] C) ASK(Amplitude Shift Keying Mod Demod [ThroughFO]</p> <p>7) Fiber Optics Transmitter/ Receiver 7.1)Analog Bandwidth. 7.2) Digital Bandwidth, 7.3) Voice Communication using mic, speaker &amp; Fiber optics 7.3) Voice Communication using mic, speaker &amp; Fiber optics 7.4) Listening to AM/FM Radio through Fiber link 8) Pseudo Random Binary Sequence Generator {PRBS} 9) Study of active filters, Noise generating &amp; elimination. A) Study of pink Noise Generator B) Study of Signal To Noise Ratio of an Amplifier C) Study of active 2nd &amp; 4th</p> |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |   |      |  |  |  |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--|--|--|
|    | <p>order Low Pass Filter D) Study of Frequency response of HPF / AC Amplifier [3] E) Study of Frequency response of / AC Amplifier [1.6k]</p> <p>Channel Pulse Cods {PCM} Modulation / Demodulation with frame &amp; bit Error Detection &amp; synchroization &amp; Correction Expt. Panel: (provided with 22 bannan+ 6 TPs 20 Leds)</p> <ul style="list-style-type: none"> <li>• Switched faults:- 4 Nos.+2 NO Swiyches for bit error simulation.</li> <li>• 1 &amp; 2 Ch TDM /PCM Mod- Demod:- 1/2/3 Wire Communication</li> </ul> <p>a) Modulator: Analog i/p:-2Nos, 10 Vpp , onborad Two adjustable variable DC source, Samplig Freq. 16 KHz per Chaannel for Fats mode &amp; 0. 106 Hz per Channel for SlowMode, use of PRBS to generate frame marker useful to estabish syc. Receiver during ½ wire communication.</p> <p>b) De-Modulator: Synchronization is established by using Pesudo Random Binary Sequence, Clock Regeneration using PLL.</p> <p>c) Frame &amp; Bit Error Detection: Use PRBS for synchronization. Selectable Even, Odd parity (Binary cyclic) &amp; Hamming (Linear Block Code)</p> <p>d) Error Correction: Single of Double Data bit error correction using Hamming code.</p> <ul style="list-style-type: none"> <li>• Voice communication using wired PCM.</li> <li>• Voice communication using Fiber optics (CM1) &amp; PCM.</li> <li>• List Experiments (8): Single channel Pulse Code Modulation &amp; Demoduiaion by various method 3/2/1 wires [mode 1,2,3 respectively] Tow channel TDM, PCM Modulation by various method 3/2/1 wires [mode 1,2,3 respectively], use of PRBS for frame. Synchronnization by adding a Bit (Marker) in 2 /1 Wire (Mode 2, 3 respectivele), Study of Error Code Check such as Even Prity, odd parity and 1 bit /2 bit error simulation &amp; correction by Hamming Code, Voice and Radio communication using PCM, Study of ADC / DAC [CODEC] by observing on Leds &amp; by applying DC at single or both i/ps, Switched Faults, Study of eye diagram, PC Communication using PCM.</li> </ul> |   |      |  |  |  |
| 18 | <p><b>Communication Systems Trainer ( DPCM, ADPCM)</b></p> <p>Salient Features</p> <ul style="list-style-type: none"> <li>• Aesthetically, designed injection molded desk (Master unit) carrying useful experiment resources like power supplies, Multi Function generators, FM/AM/FO Transmitter/receiver, MIC and L/S amplifier, Butteworth Filter (BWF), Sync sine waves etc. while central slot will hold various replaceable experiment panels, Order 10 Mus+ 10 panels sets or mu</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1 | EACH |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p> multiples.<br/> • Connection through sturdy 4mm Banana sockets, patch cords, ST Connectors., NC Connectors.<br/> • Student workbook &amp; instructor's Guide provided.<br/> Specifications of Master Unit<br/> • Built in DC power Supply:<br/> - 5V/1A, = 12V/500mA, 0 to -15V DC (Variable) /100mA,0 to 15V DC (Variable)/100mA.<br/> • Waveform Generator:<br/> 19) Carrier Generator<br/> - Waveform: SINE/TRG/TTL/CMOS(settable).<br/> - Output Frequency: 1 Hz to 1 MHz<br/> - Output Voltage:0-20Vpp.<br/> - Controls: Frequency &amp; Amplitude control pots.<br/> - Modulation: AM (std.)- 1/p volt-=5V,0V-No modulation AM(DSBSC)- 1/p volt. 0-9.8 VPP, volt.0- 2.7, FM I/p volt. 400mV (=50%modulation). ASK-I/p upto 500Hz, =5V Square wave, FSK-I/P upto 500Hz, =4.5V Square wave<br/> 20) Audio Oscillator:<br/> - Waveform: SINE/TRG/SQUARE<br/> - Output Frequency:50Hz to 5KHz<br/> - Output Voltage: sine 0-2VppSq.0-9Vpp, TRG.0-3pp.<br/> - Controls: Freq. &amp; amplitude control pots.<br/> 21) Synchronized Sine Wave Generator:<br/> - Input: 32 KHz TTL /P to Generate 4 nos. of sync. Sine O/P<br/> - Waveform: SINE<br/> - Output Frequency: 250/500/1000/2000 Hz<br/> - Output Voltage:0-10Vpp<br/> - Controls: Amplitude control pot<br/> - Mic. with Pre Amp. Hand held Electret /dynamic microphone with preamplifier for audio range. Audio Amplifier: Variable Gain upto 20 for Audio range, Built in Loudspeaker-8 ohm/500mW/earphone.<br/> - Pink Noise Gen: Frequency response of filter for audio range.<br/> - Buffer/AC amplifier: NIV gain amplifier 2 nos., Gain -0 20, For Non sinusoidal Signal Generator cum l NV buffer.<br/> - BNC TO Banana Converter: Converts 1 BNC Socket to 2 Banana Socket (4mm)&amp; Vice Versa. Butter Worth Filter [LPF]: 4Non-2 pole/4 butter worth filter cutoff freq 3.4 KHz Audio range. Pseudo Random Binary Sequence generator: Switch settable for on/off fix 15 bit PRBS Generator, will also function as input digital data stream generator<br/> • Wireless Communication:<br/> - 1a. FM Transmitter (Transistorized): </p> |  |  |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>s) Carrier Tunable form 88 MHz to 108 MHz with built in FM[VCD]</p> <p>t) Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</p> <p>u) Tx power O/P: 50to :100mW</p> <p>- 1b. FM Receiver: External 5 BS5 to connect to antenna, 2ndlf Input,2nd IF Output, speaker &amp;Audio amplifier, AM/FM select switch, L/S impedance 8 ohm/0.5W.</p> <p>- Controls(Manually)Settable 88 to 108 MHz</p> <p>- Antenna/ Transmission: Telescopic antenna [3branch antenna] optional.</p> <p>• 2a.AM Transmitter (Transistorized):</p> <p>- Carrier: 500KHz to 1.5MHz</p> <p>- Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</p> <p>- Tx Power Output:50 to100mW.</p> <p>• 2b. AM Receiver: External 5BS5 to connect to antenna, 2nd IF Input, 2nd IF O/P, speaker &amp;Audio amplifier, AM/FM Select switch, L/S impedance 8ohm/o.5W</p> <p>- Controls(Manually): Gain control settable form 0 to 4.5V</p> <p>• 3a. Fiber Optics Transmitter:</p> <p>- Data Input Bandwidth:500kHz to1.5MHz.</p> <p>- Modulating Signal: Amplitude-5Vpp. Freq-Audio Range</p> <p>- Tx Power Output: 50 to 100mW.</p> <p>• 3b. FO Receiver: Detector (tr=8ms) separate BS5 socket for digital, AC couled &amp;TTL o/ps.</p> <p>- Controls (Manually bias control.</p> <p>- Antenna /Transmission: 1m plastic fiber cable, CRT-1-492,NA-0.5,-660nm,step index. Terminated with SMA connector.</p> <p>BB) Operating Voltage:220/240Vac switch settable <math>\pm 10\%</math>, 50Hz/35VA.</p> <p>List of Experiment on Master Unit (9): 1) Voice link using mic.&amp; LS amplifier,2)Study of AM Xmitter / Receiver,3) Study of FM Xmitter/Receiver,4) Band determination of PLL as FM Detector,5) A) PLL as FM Detector, B) FSK (Frequency Shift Keying) Mod/Demod [Wired] C)FSK(Frequency Shift Keying) MOD/ Demod through[FO]</p> <p>6) A) Diode as AM Detector b) ASL (Amplitude Shift Keying)Mod/Demod. [Wired] C) ASK(Amplitude Shift Keying Mod Demod [ThroughFO]</p> <p>7) Fiber Optics Transmitter/ Receiver 7.1)Analog Bandwidth. 7.2) Digital Bandwidth, 7.3) Voice Communication using mic, speaker &amp; Fiber optics 7.3) Voice Communication using mic, speaker &amp; Fiber optics 7.4) Listening to AM/FM Radio through Fiber link 8) Pseudo Random Binary Sequence Generator {PRBS} 9) Study of active filters, Noise generating &amp; elimination. A) Study of pink Noise Generator B) Study of Signal To Noise Ratio of an Amplifier C) Study of active 2nd &amp; 4th</p> |  |  |  |  |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>order Low Pass Filter D) Study of Frequency response of HPF / AC Amplifier [3] E) Study of Frequency response of / AC Amplifier [1.6k]</p> <p>• DPCM/ADPCM Modulation Expt. Panel: (Provided with 13 banana + 3 TPs +20 LED + 6 switches) Operation mode: Switch selectable- DPCM OR ADPCM Number of data bits in data frame switch selectable 3/4/5 bits. On-board Clock source @ 600 KHz. Modulator Function Blocks:- 1 analog input- 10Vpp &amp; Audio upto 2khz, Onboard adjustable DC signal source, ADC Sample Frequency @8.5 KHz, 7 Bit Comparator, Subtractor, Signed Adder, Parallel to Serial Converter. b) Demodulator Function Blocks:- 1 Analog Output – 10Vpp &amp; Audio upto 2KHz. Demodulated DPCM / ADPCM signal reconstructed using 7 bit DAC followed by passing through 2p/4p Butterworth filter on NGLPF panel (MU). Serial to Parallel Converter, 7 bit Signed Adder, List of experiments (): DPCM-Modulation – Demodulation, ADPCM-Modulation, Slope Overload Error, Voice Communication using DPCM/ADPCM, Study of Eye Diagram.13) QAM Modulation/Demodulation Expt. Panel (cm12) (Provided with 12 banana +2 TPs. 12 LED +5 switches) On-board Clock source @1.2 MHz. a) Modulator Function Blocks:- 1 Analog Input- 10Vpp &amp; Audio upto 30Hz [1KHz}. Onboard adjustable DC signal source, ADC Sampling Frequency @ 1.5KHz. 7Bit ADC Signal Adder. Quadrature sine generator I.Q @ 55KHz, Mux and Latch. B) Demodulator Function Block:- Analog Output- 10VPP &amp; Audio upto 300Hz [1KHz], switch selectable DAC O/P either 16 QAM O/P or Demod O/P, original signal recovered by passing through 2p/4p Butterworth filter on NGLPF Panel (MU), 7Bit DAC, Signed Adder, 7 Bit Amplitude &amp; Phase comparator, Latch &amp; Mux. List of experiments (6). Generate 16 QAM modulated sin output, Verify constancy of frequency but only Phase angle and amplitude, Verify depending upon modulation bits, Draw constellation diagram for 16 QAM, Determine upper limit of data rate given a particular carrier frequency. Send and receive voice using 16 QAM, Cycle slip error 14) Channel CDMA Modulation/ Demodulation Expt. Panel (CM13) (provided with 12 banana + LEDs + 2TPs + 5 switches) ON- board source @ 1.2 MHz. a) Modulator Function Blocks:</p> |  |  |  |  |  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |   |      |  |  |  |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------|--|--|--|
|    | <p>High speed 7 bit ADC &amp; 4 station data (sequence generator ), 4 parallel in serial out (PISO) converter, chip sequence (M=8) generators, signet digital adder, modulation control mode selct switches, CDMA clock control logic. b) Demodulator function Blocks: Signed synchronous multiplier, station select mux bipolar to unipolar converter,serial in parallel out (SIPO) and 7 bit DAC. List of experiments (6) Verification of CDMA modulation algorithm at o/p of DAC, Recovery of selected station data out of 4 stations, Upper frequency limit for recovery of voce frequency(Bandwidth detemination), Voice communication, Study of ADC (Codec), Study of Eye Diagram.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |   |      |  |  |  |
| 19 | <p><b>Communication Systems Trainer (CDMA)</b><br/> Aesthetically, designed injection molded desk(Master unit) carrying useful experime nt resources like power supplies, Multi Function generators, FM/AM/FO Transmitter/receiver, MIC and L/S amplifier, Butteworth Filter (BWF), Sync sine waves etc. while central slot will hold various replaceable experiment panels, Order 10 Mus+ 10 panels sets or mu multiples.</p> <ul style="list-style-type: none"> <li>• Connection through sturdy 4mm Banana sockets, patch cords, ST Connectors., NC Connectors.</li> <li>• Student workbook &amp; instructor's Guide provided.</li> </ul> <p>Specifications of Master Unit</p> <ul style="list-style-type: none"> <li>• Built in DC power Supply:<br/> - 5V/1A, = 12V/500mA, 0 to -15V DC (Variable) /100mA,0 to 15V DC (Variable)/100mA.</li> <li>• Waveform Generator:<br/> 22) Carrier Generator<br/> - Waveform: SINE/TRG/TTL/CMOS(settable).<br/> - Output Frequency: 1 Hz to 1 MHz<br/> - Output Voltage:0-20Vpp.<br/> - Controls: Frequency &amp; Amplitude control pots.<br/> - Modulation: AM (std.)- 1/p volt.=5V,0V-No modulation<br/> AM(DSBSC)- 1/p volt. 0-9.8 VPP, volt.0- 2.7, FM I/p volt. 400mV (=50%modulation).<br/> ASK-I/p upto 500Hz, =5V<br/> Square wave, FSK-I/P upto 500Hz, =4.5V Square wave<br/> 23) Audio Oscillator:<br/> - Waveform: SINE/TRG/SQUARE<br/> - Output Frequency:50Hz to 5KHz<br/> - Output Voltage: sine 0-2VppSq.0-9Vpp, TRG.0-3pp.<br/> - Controls: Freq. &amp; amplitude control pots.<br/> 24) Synchronized Sine Wave Generator:<br/> - Input: 32 KHz TTL /P to Generate 4 nos. of sync. Sine O/P<br/> - Waveform: SINE</li> </ul> | 1 | EACH |  |  |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <ul style="list-style-type: none"> <li>- Output Frequency: 250/500/1000/2000 Hz</li> <li>- Output Voltage:0-10Vpp</li> <li>- Controls: Amplitude control pot</li> <li>- Mic. with Pre Amp. Hand held Electret /dynamic microphone with preamplifier for audio range. Audio Amplifier: Variable Gain upto 20 for Audio range, Built in Loudspeaker-8 ohm/500mW/earphone.</li> <li>- Pink Noise Gen: Frequency response of filter for audio range.</li> <li>- Buffer/AC amplifier: NIV gain amplifier 2 nos., Gain -0 20, For Non sinusoidal Signal Generator cum l NV buffer.</li> <li>- BNC TO Banana Converter: Converts 1 BNC Socket to 2 Banana Socket (4mm)&amp; Vice Versa. Butter Worth Filter [LPF]: 4Non-2 pole/4 butter worth filter cutoff freq 3.4 KHz Audio range. Pseudo Random Binary Sequence generator: Switch settable for on/off fix 15 bit PRBS Generator, will also function as input digital data stream generator</li> <li>• Wireless Communication: <ul style="list-style-type: none"> <li>- 1a. FM Transmitter (Transistorized): <ul style="list-style-type: none"> <li>v) Carrier Tunable form 88 MHz to 108 MHz with built in FM[VCD]</li> <li>w) Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</li> <li>x) Tx power O/P: 50to :100mW</li> </ul> </li> <li>- 1b. FM Receiver: External 5 BS5 to connect to antenna, 2ndlf Input,2nd IF Output, speaker &amp;Audio amplifier, AM/FM select switch, L/S impedance 8 ohm/0.5W.</li> <li>- Controls(Manually)Settable 88 to 108 MHz</li> <li>- Antenna/ Transmission: Telescopic antenna [3branch antenna] optional.</li> </ul> </li> <li>• 2a.AM Transmitter (Transistorized): <ul style="list-style-type: none"> <li>- Carrier: 500KHz to 1.5MHz</li> <li>- Modulating Signal: Amplitude-5Vpp, Freq.-Audio Range.</li> <li>- Tx Power Output:50 to100mW.</li> </ul> </li> <li>1 <ul style="list-style-type: none"> <li>• 2b. AM Receiver: External 5BS5 to connect to antenna, 2nd IF Input, 2nd IF O/P, speaker &amp;Audio amplifier, AM/FM Select switch, L/S impedance 8ohm/o.5W</li> <li>- Controls(Manually): Gain control settable form 0 to 4.5V</li> </ul> </li> <li>• 3a. Fiber Optics Transmitter: <ul style="list-style-type: none"> <li>- Data Input Bandwidth:500kHz to1.5MHz.</li> <li>- Modulating Signal: Amplitude-5Vpp. Freq-Audio Range</li> <li>- Tx Power Output: 50 to 100mW.</li> </ul> </li> <li>• 3b. FO Receiver: Detector (tr=8ms) separate BS5 socket for digital, AC couled &amp;TTL o/ps.</li> <li>- Controls (Manually bias control.</li> <li>- Antenna /Transmission: 1m plastic fiber cable, CRT-1-</li> </ul> |  |  |  |  |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|
| <p>492,NA-0.5,-660nm,step index.<br/>Terminated with SMA connector.<br/>FF) Operating Voltage:220/240Vac switch settable <math>\pm 10\%</math>,<br/>50Hz/35VA.<br/>List of Experiment on Master Unit (9): 1) Voice link using<br/>mic.&amp; LS amplifier,2)Study of AM<br/>Xmitter / Receiver,3) Study of FM Xmitter/Receiver,4) Band<br/>determination of PLL as FM<br/>Detector,5) A) PLL as FM Detector, B) FSK (Frequency Shift<br/>Keying) Mod/Demod [Wired]<br/>C)FSK(Frequency Shift Keying) MOD/ Demod through[FO]<br/>6) A) Diode as AM Detector b) ASL (Amplitude Shift<br/>Keying)Mod/Demod. [Wired] C)<br/>ASK(Amplitude Shift Keying Mod Demod [ThroughFO]<br/>7) Fiber Optics Transmitter/ Receiver 7.1)Analog Bandwidth.<br/>7.2) Digital Bandwidth, 7.3) Voice<br/>Communication using mic, speaker &amp; Fiber optics 7.3) Voice<br/>Communication using mic, speaker &amp;<br/>Fiber optics 7.4) Listening to AM/FM Radio through Fiber<br/>link 8) Pseudo Random Binary Sequence<br/>Generator {PRBS} 9) Study of active filters, Noise generating<br/>&amp; elimination. A) Study of pink<br/>Noise Generator B) Study of Signal To Noise Ratio of an<br/>Amplifier C) Study of active 2nd &amp; 4th<br/>order Low Pass Filter D) Study of Frequency response of HPF<br/>/ AC Amplifier [3] E)Study of<br/>Frequency response of / AC Amplifier [1.6k]<br/>4 Channel CDMA Modulation / Demodulation Expt. Panel<br/>(Provided with 12 banana + 7 LEDs + 2TPs + 5 switches)<br/><input type="checkbox"/> On-board Clock source @1. 2 MHZ<br/>a) Modulator Function Blocks : High speed 7 bit ADC &amp; 4<br/>station data<br/>(sequence generator), 4 parallel in serial out (PISO) converter,<br/>4 chip sequence (m=8) generators,<br/>signed digital adder, modulation control mode select switches,<br/>CDMA clock control logic.<br/>b) Demodulator Function Blocks : Signed synchronous<br/>multiplier, station select mux, bipolar to<br/>unipolar converter, serial in parallel out (SIPO) and 7bit DAC.<br/>List of experiments (6) : Verification of CDMA modulation<br/>algorithm at o/p of DAC, Recovery of<br/>selected station data out of 4 stations, Upper frequency limit<br/>for recovery of voice frequency<br/>(Bandwidth determination), Voice communication, Study of<br/>ADC &amp; DAC (Codec), Study of Eye<br/>Diagram.</p> |  |  |  |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|

## &lt;&lt;Organization letter Head&gt;&gt;

**DECLARATION SHEET**

We \_\_\_\_\_ hereby certify that all the information and data furnished by our organization with regard to this tender specification are true and complete to the best of our knowledge. We have gone through the specification, conditions and stipulations in details and agree to comply with the requirements and intent of specification.

This is certified that our organization has been authorized (Copy attached) by the OEM to participate in Tender. We further certify that our organization meets all the conditions of eligibility criteria laid down in this tender document. Moreover, OEM has agreed to support on regular basis with technology/ product updates and extend support for the warranty.

The prices quoted in the financial bids are subsidized due to academic discount given to Dr. Shakuntala Misra National Rehabilitation University, Mohaan Road, Lucknow.

|                                                                                                                                                                                              |                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| We, further specifically certify that our organization has not been Black Listed/ De-Listed by an Institutional Agency/ Govt. Department/ Public Sector Undertaking in the last three years. | NAME AND ADDRESS OF THE Vendor/ Manufacturer/Agent |
| 1 Phone                                                                                                                                                                                      |                                                    |
| 2 Fax                                                                                                                                                                                        |                                                    |
| 3 E-mail                                                                                                                                                                                     |                                                    |
| 4 Contact Person Name                                                                                                                                                                        |                                                    |
| 5 Mobile Number                                                                                                                                                                              |                                                    |
| 6 GST Number                                                                                                                                                                                 |                                                    |
| 7 PAN Number                                                                                                                                                                                 |                                                    |
| 8 Tender Fees D.D. in favour of Finance Officer, DSMNRU, Lucknow.                                                                                                                            |                                                    |
| 9 EMD through D.D./Banker's Cheque in favour of Finance Officer, DSMNRU, Lucknow.                                                                                                            |                                                    |
| 10 Bank details of the bidder                                                                                                                                                                |                                                    |
| a) Name of the Bank                                                                                                                                                                          |                                                    |
| b) Account Number                                                                                                                                                                            |                                                    |
| c) Kindly attach scanned copy of one Cheque book page to enable us to return the EMD to unsuccessful bidder.                                                                                 |                                                    |

**(Signature of the Tenderer)**

**Name:** \_\_\_\_\_

**Seal of the Company**

**LETTER OF UNDERTAKING  
(ON THE LETTER HEAD OF THE BIDDER)**

To,  
Registrar  
Dr. Shakuntala Misra National Rehabilitation University,  
Mohaam Road,  
Lucknow-226017  
India

Sir,

**SUBJECT-** Supply, Installation and Commissioning of .....  
Laboratory Equipment of Engineering and Technology at Dr. Shakuntala  
Misra National Rehabilitation University, Mohaan Road, Lucknow (Uttar  
Pradesh).

This bears reference to Dr. Shakuntala Misra National Rehabilitation  
University, Mohaan road, Lucknow Bid No. .... Dated on \_\_ (DD)/\_  
\_ (MM)/20\_\_ (YYYY). We, hereby, accept all the terms and conditions for  
submitting bid as mentioned in this Bid Document.

We hereby certify that no terms and conditions have been stipulated by us in  
the Financial Bid.

We warrant that the services do not violate or infringe upon any patent,  
copyright, trade secret or other property right of any other person or other  
entity. We agree that we shall not prevent Dr. Shakuntala Misra National  
Rehabilitation University, Mohaan Road, Lucknow from any claim or demand,  
action or proceeding, directly or indirectly resulting from or arising out of  
any breach or alleged breach of any of the terms and conditions of bid  
document and contract.

The above document is executed on \_\_ (DD)/\_\_ (MM)/20\_\_ (YYYY) at (place)  
\_\_\_\_\_ and we accept that if anything out of the information  
provided by us is found wrong/false/incorrect; our bid/work order shall be  
liable for rejection.

Thanking you,  
Yours faithfully,

**Name of the Bidder** \_\_\_\_\_  
**Authorized Signatory** \_\_\_\_\_  
**Seal of the Organization** \_\_\_\_\_

Date:  
Place:

**UNDERTAKING**

This is to confirm that we M/s \_\_\_\_\_  
\_\_\_\_\_ (give full address) have not been declared neither failed to perform on any Agreement, nor have been expelled from any project or Agreement nor any Agreement terminated for breach by the us (Agency) in any of the government department and public sector undertaking /enterprise or by any other Client in India, in last five year before release of advertisement.

If the above information found false at any stage after the placement of Work Order /Supply Order /Agreement, Dr. Shakuntala Misra National Rehabilitation University, Mohaan Road, Lucknow (Uttar Pradesh) will have full right to cancel the contract and forfeit the Performance Guarantee. All the direct and indirect cost related to the cancellation of the order will be borne by us besides any legal action by Dr. Shakuntala Misra National Rehabilitation University, Mohaan Road, Lucknow (Uttar Pradesh).which shall be deemed fit at that point of time.

**Authorized Signatory**

Note: The undertaking regarding the non-blacklisting of firm is to be submitted on a non-judicial stamp paper of Rs. 100/- (Rupees Hundred only).

**Annexure -X****ANNUAL AVERAGE TURN OVER**

| <b>Sl. No.</b> | <b>Financial Year</b> | <b>Annual Average Turn Over (in lakhs)</b> |
|----------------|-----------------------|--------------------------------------------|
| <b>1.</b>      | 2017 – 2018           |                                            |
| <b>2.</b>      | 2018– 2019            |                                            |
| <b>3.</b>      | 2019 – 2020           |                                            |

Note: Certificate from Statutory Auditor/ Chartered Accountant certifying balance sheet only for all three years to be attached.

**Signature with Seal of  
the Chartered Accountant**

**Signature with Seal of the  
Bidder**

**Annexure -XI**

**Details of Projects Completed During Last 03 Financial Years**

Bid Number:

Date of Opening:

Time:

Name of the Firm:

| <b>Sl. No .</b> | <b>Name of the Projects</b> | <b>Order No. and Date</b> | <b>Description &amp; quantity of ordered equipment</b> | <b>Value of order (in lakhs )</b> | <b>Date of Start</b> | <b>Scheduled Date of Completion</b> | <b>Actual Date of Completion</b> | <b>Reason for Delay (if any)</b> |
|-----------------|-----------------------------|---------------------------|--------------------------------------------------------|-----------------------------------|----------------------|-------------------------------------|----------------------------------|----------------------------------|
|                 |                             |                           |                                                        |                                   |                      |                                     |                                  |                                  |
|                 |                             |                           |                                                        |                                   |                      |                                     |                                  |                                  |
|                 |                             |                           |                                                        |                                   |                      |                                     |                                  |                                  |
|                 |                             |                           |                                                        |                                   |                      |                                     |                                  |                                  |
|                 |                             |                           |                                                        |                                   |                      |                                     |                                  |                                  |

**Signature  
with Seal**

**Annexure -XII**

**List of Order executed for Govt. Organization/ Department/ University  
during Last Three Financial Years**

| List of Govt./PSU's/Autonomous bodies/ Govt. Institutions such as IIT's/NIT's/IIIT's/Central Universities/ State Universities/ Rajkiya Engineering College (Uttar Pradesh), etc. for whom the Bidder has undertaken such work during last three financial years (must be supported with work orders) |                     |                        |                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|------------------------|------------------------------------------|
| Name of the organization                                                                                                                                                                                                                                                                             | Year of Procurement | Total Value (in Lakhs) | Name of Contact Person and other details |
|                                                                                                                                                                                                                                                                                                      |                     |                        |                                          |
|                                                                                                                                                                                                                                                                                                      |                     |                        |                                          |
|                                                                                                                                                                                                                                                                                                      |                     |                        |                                          |
|                                                                                                                                                                                                                                                                                                      |                     |                        |                                          |
|                                                                                                                                                                                                                                                                                                      |                     |                        |                                          |

**Technical Competency Details**

| Name of application specialist / Service Engineer who have the technical competency to handle and support the quoted product during the warranty period |                        |             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------|
| Name of the organization                                                                                                                                | Name of Contact Person | Contact No. |
|                                                                                                                                                         |                        |             |
|                                                                                                                                                         |                        |             |
|                                                                                                                                                         |                        |             |

**Details of Service Supports/Closest Service Station**

| Sl. No. | Full Address of Service Supports/Closest Service Station along with contact Nos. | Type of Service Supports/Closest Service Station |
|---------|----------------------------------------------------------------------------------|--------------------------------------------------|
|         |                                                                                  |                                                  |
|         |                                                                                  |                                                  |

**Signature of Bidder**  
**Name:**  
**Designation:**  
**Organization Name:**  
**Contact No. :**

**POWER OF ATTORNEY**

Know all men by these presents, We.....  
 (Name of firm and address of the Registered office) do hereby constitute  
 nominate appoint and authorize Mr./Ms..... Son/  
 daughter/wife of and presently residing at....., who  
 is presently employed with/ retained by us and holding position of  
 .....as our true and lawful attorney.(hereinafter referred  
 to as the "Authorized Representative") to do in our name and on our behalf,  
 all such acts, deeds and things are necessary or required in connection or  
 incidental to submission of our proposal for and selection as the <Name of  
 the Work> for the <name of the client> .....work,  
 proposed to be developed by the .....(the "client")  
 including but not limited to signing and submission of all applications,  
 proposals and other documents and writings, participating in pre bid and  
 other conferences and providing information/responses to the client,  
 representing us in all matters before the client, signing and excavation of all  
 contracts and undertaking consequents to acceptance of our proposal and  
 generally dealing with the client in all matter in connection with or relating to  
 or arising out of our proposal for the said projector upon award thereof to us  
 till the entering into of the agreement with the client.

AND, we do hereby agree to ratify and confirms all the acts, deeds and things  
 lawful done or caused to be done by our said Authorized Representative  
 pursuant to and in exercise of the powers conferred by this power and  
 Attorney and that all the acts, and things done by our said Authorized  
 Representative in exercise of the powers hereby conferred shall and shall  
 always be deemed to have been done by us.

[IN WITNESS WHEREOF WE .....THE ABOVE NAMED  
 PRINCIPAL HAVE EXECUTED THIS POWER OF ATTORNEY ON  
 THIS.....DAYS OF.....2020.

For..... (Name and registered address of  
 client)

(Signature, name, designation and address)

Witness:

1. (Signature, name and address)
2. (Signature, name and address)

Notarized

Accepted ..... (Signature, name, designation  
 and address of the Attorney)

Notes:

1. The mode of the execution of the power of Attorney shall be in accordance  
 with the procedure, if any, laid down by the application law and the charter  
 documents of the executions (s) and when it is so required the same should  
 be under seal affixed in accordance with the required procedure.
2. Whenever required, the application should have submitted for verification  
 the extract of the charter documents and other documents such as  
 resolution/Power of Attorney in favor of the applicant.

**LETTER OF BID SUBMISSION**

To,  
Registrar  
Dr. Shakuntala Misra National Rehabilitation University,  
Mohaan Road, Lucknow  
Uttar Pradesh – 226017

**SUBJECT- Supply, Installation and Commissioning of Laboratory Equipment of Engineering and Technology at Dr. Shakuntala Misra National Rehabilitation University, Mohaan Road, Lucknow, Uttar Pradesh.**

**Submission of Bid**

Sir,

Having examined the details given in Press Notice, Notice Inviting Bid & Bid Document for the above work, I/we hereby submit the relevant information:

- 1) I/We hereby certify that all the statements made and information supplied in the enclosed form..... and accompanying statements are true and correct to the best of my/our knowledge and belief and nothing has been concealed.
- 2) I/we certify that we have not changed/alterd any word/sentence or any figure in number/s or words appearing the original tender document uploaded by Dr. Shakuntala Misra National Rehabilitation University on the designated web page for e-tendering. In case, if a fraudulent activity is found at any stage between tender submission to final closure of the tender/contract, my/our candidature/bid/contract shall be immediately cancelled and EMD/Performance security/ security deposit along with the due amount towards the work executed or advance shall be forfeited. Dr. Shakuntala Misra National Rehabilitation University may not entertain any claim or entertain any reason for this act. Dr. Shakuntala Misra National Rehabilitation University may go for the legal action against the bidder for recovering any one or all damages caused to Dr. Shakuntala Misra National Rehabilitation University.
- 3) I/We have furnished all information and details necessary for eligibility and have no further pertinent information to supply.
- 4) I/We submit the requisite certified solvency certificate and authorize the Dr. Shakuntala Misra National Rehabilitation University to approach the Bank issuing the solvency certificate to confirm the correctness thereof. I/We also authorize Dr. Shakuntala Misra National Rehabilitation University to approach individuals, employers, firms and corporation to verify our competency and general reputation.
- 5) I/We submit the following certificates in support of our suitability, technical knowledge and capability for having successfully completed the following works:

| <b>Sl. No.</b> | <b>Name of Work</b> | <b>Certificate From</b> |
|----------------|---------------------|-------------------------|
|                |                     |                         |
|                |                     |                         |
|                |                     |                         |

- 6) Earnest Money Deposit amounting to Rs..... is submitted.  
7) Cost of tender document of Rs...../- is submitted. Enclosures:

Thanking you,  
Yours faithfully,

**Name of the Bidder.....**  
**Authorized Signatory.....**  
**Seal of the Organization.....**

Date:

Place:

**PERFORMANCE BANK GUARANTEE FORMAT**

Name of the Bank:.....

To,  
Registrar  
Dr. Shakuntala Misra National Rehabilitation University,  
Mohaam Road, Lucknow  
Uttar Pradesh – 226017

In consideration of the Registrar Dr. Shakuntala Misra National Rehabilitation University having agreed under the terms and conditions of agreement/ Contract Acceptance letter No.:.....  
Dated:.....made  
between..... (Designation & address  
of contract signing Authority)  
and.....(here in after called “the said  
Agency”) for the work.....(here in after called “the  
said agreement”) having agreed for submission of an irrevocable Bank  
Guarantee Bond for..... (only) as a performance  
security Guarantee from the Agency for compliance of his obligations in  
accordance with the terms & conditions in the said agreement.

- 1) We..... (Indicate the name of the Bank)  
hereinafter referred to as the Bank, undertake to pay to the Dr. Shakuntala  
Misra National Rehabilitation University, Mohaan Road, Lucknow, Uttar  
Pradesh an amount not  
exceeding.....(..... only) on  
demand by the Dr. Shakuntala Misra National Rehabilitation University.
- 2) We..... (Indicate the name of the bank,  
further agree that (and promise) to pay the amounts due and payable under  
this guarantee without any demur merely on a demand from the Dr.  
Shakuntala Misra National Rehabilitation University through the Registrar,  
Dr. Shakuntala Misra National Rehabilitation University, Mohaan Road,  
Lucknow or..... (Designation &  
Address of contract signing authority), stating that the amount claimed is  
due by way of loss or damage caused to or would be caused or suffered by  
the Dr. Shakuntala Misra National Rehabilitation University, Lucknow by  
reason of any breach by the said Agency of any of the terms of conditions  
contained in the said agreement or by reason of the Agency failure to  
perform the said agreement. Any such demand made on the Bank shall be  
conclusive as regards the amount due and payable by the Bank under this  
guarantee. However, our liability under this guarantee shall be restricted to  
an amount not exceeding Rs.....  
(Rupees.....only).
- 3) (a) We..... (indicate the name of Bank)  
further undertake to pay to the Dr. Shakuntala Misra National Rehabilitation  
University any money so demanded notwithstanding any dispute or dispute  
raised by the Agency in any suite or proceeding pending before any court or

Tribunal relating to liability under this present being absolute and unequivocal. (b) The payment so made by us under this Performance Guarantee shall be a valid discharge of our liability for payment there under and the Agency shall have no claim against us for making such payment.

- 4) We..... (Indicate the name of bank) to further agree that the guarantee herein contained shall remain in full force and effect during the period that would be taken for the performance of the said agreement and that it shall continue to be enforceable till all the dues of the Dr. Shakuntala Misra National Rehabilitation University under or by virtue of the said agreement have been fully paid and its claims satisfied or discharged by..... (Designation & Address of contract signing authority) on behalf of Dr. Shakuntala Misra National Rehabilitation University, Mohaan Road, Lucknow, certify that the terms and conditions of the said agreement have been fully and properly carried out by the said Agency and accordingly discharges this guarantee.
- 5) (a) Notwithstanding anything to the contrary contained herein the liability of the bank under this guarantee will remain in force and effect until such time as this guarantee is discharged in writing by the Dr. Shakuntala Misra National Rehabilitation University or until (date of validity/ extended validity) whichever is earlier and no claim shall be valid under this guarantee unless notice in writing thereof is given by the Dr. Shakuntala Misra National Rehabilitation University within validity/ extended period of validity of guarantee from the date aforesaid. (b) Provided always that we..... (indicate the name of the Bank) unconditionally undertakes to renew this guarantee or to extend the period of guarantee form year to year before the expiry of the period or the extended period of the guarantee, as the case shall be on being called upon to do so by the Dr. Shakuntala Misra National Rehabilitation University. If the guarantee is not renewed or the period extended on demand, we..... (indicate the name of the Bank) shall pay the Dr. Shakuntala Misra National Rehabilitation University the full amount of guarantee on demand and without demur.
- 6) We..... ( indicate the name of Bank ) further agree with the Dr. Shakuntala Misra National Rehabilitation University that the Dr. Shakuntala Misra National Rehabilitation University shall have the fullest liberty without our consent and without effecting in any manner out of obligations hereunder to vary any of the terms and conditions of the said contract from time to time or to postpone for any time or from time to time any to the powers exercisable by Dr. Shakuntala Misra National Rehabilitation University against the said Agency and to forbear or enforce any of the terms and conditions of the said agreement and we shall not be relieved from our liability by reason of any such variation, or extension being granted to the said Agency for any bearance act or omission on the part of Dr. Shakuntala Misra National Rehabilitation University or any indulgence by Dr. Shakuntala Misra National Rehabilitation University to the said Agency for by any such matter or thing whatsoever under the law relating to sureties for the said reservation would relive us from the liability.

- 7) This guarantee will not be discharged by any change in the constitution of the Bank or the Agency.
- 8) We.....(indicate the name of the Bank) lastly undertake not to revoke this guarantee except with the previous consent of Dr. Shakuntala Misra National Rehabilitation University in writing.
- 9) This guarantee shall be valid up to (Date of Completion plus Handholding Period). Unless extended on demand by Dr. Shakuntala Misra National Rehabilitation University. Notwithstanding anything to the contrary contained hereinbefore, our liability under this guarantee is restricted to Rs..... (Rs.....only) unless a demand under this guarantee is made on us in writing on or before.....We shall be discharged from our liabilities under this guarantee thereafter.

Dated: .....the..... Day of.....  
for..... (indicate the name of bank)

**Signature of Banks Authorized  
official Witness**

(Name).....  
Designation with Code  
No.....  
Full Address.....

**PROFORMA PRE CONTRACT INTEGRITY PACT****GENERAL**

This pre-bid pre-contract Agreement (hereinafter called the Integrity Pact) is made on..... day of the month..... of 2020, between, on one hand, acting through Shri/Smt. , Designation, Dr. Shakuntala Misra National Rehabilitation University (hereinafter called the “BUYER”/ “Dr. Shakuntala Misra National Rehabilitation University” interchangeably, which expression shall mean and include, unless the context otherwise requires, his successors in office and assigns) of the First Part.

**AND**

M/s..... represented by Shri....., Chief Executive Officer (hereinafter called the “BIDDER/Seller” which expression shall mean and include, unless the context otherwise requires, his successors and permitted assigns) of the Second Part. WHEREAS the Dr. Shakuntala Misra National Rehabilitation University proposes to procure services towards “Supply, Installation and Commissioning of.....Laboratory Equipment at Dr. Shakuntala Misra National Rehabilitation University ” For its clients and BIDDER/Seller is willing to offer the said services and related items as referred to in the Bid document No. .... / 2020 Dated ..... 2020.

WHEREAS the BIDDER is a private company /public company / Government undertaking / partnership / registered expert agency, constituted in accordance with the relevant law in the matter and Dr. Shakuntala Misra National Rehabilitation University is an autonomous body of Uttar Pradesh Government.

**NOW, THEREFORE,**

To avoid all forms of corruption by following a system that is fair, transparent and free from any influence / prejudiced dealings prior to, during and subsequent to the currency of the contract to be entered into with a view to: Enabling the Dr. Shakuntala Misra National Rehabilitation University to obtain the desired services as referred to in the Bid document No. .... dated .....2020 at a competitive price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement and Enabling BIDDERS to abstain from bribing or indulging in any corrupt practice in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing and other corrupt practices and the Dr. Shakuntala Misra National Rehabilitation University will commit to prevent corruption, in any form, by its officials by following transparent procedures. The parties hereto hereby agree to enter into this Integrity Pact and agree as follows:

**1) Commitments of the DSMNRU:**

DSMNRU undertakes that no official of DSMNRU, connected directly or indirectly with the contract, will demand, take a promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favour or any material or immaterial benefit or any other advantage from the BIDDER, either for themselves or for any person, organization or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to the contract.

The BUYER will, during the pre-contract stage, treat all BIDDERS alike, and will provide to all BIDDERS the same information and will not provide any such information to any particular BIDDER which could afford an advantage to that particular BIDDER in comparison to other BIDDERS.

All the officials of the DSMNRU will report to the appropriate Government office any attempted or completed breaches of the above commitments as well as any substantial suspicion of such a breach.

- 2) In case any such preceding misconduct on the part of such official(s) is reported by the BIDDER to the DSMNRU with full and verifiable facts and the same is prima facie found to be correct by the DSMNRU, necessary disciplinary proceedings, or any other action as deemed fit, including criminal proceedings shall be initiated by DSMNRU and such a person shall be debarred from further dealings related to the contract process. In such a case while an enquiry is being conducted by the DSMNRU the proceedings under the contract would not be stalled.

**3) Commitments of Bidders**

The BIDDER commits itself to take all measures necessary to prevent corrupt practices, unfair means and illegal activities during any stage of its bid or during any pre-contract or post-contract stage in order to secure the contract or in furtherance to secure it and in particular commit itself to the following:

The BIDDER will not offer, directly or through intermediaries, any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the DSMNRU, connected directly or indirectly with the bidding process, or to any person, organization or third party related to the contract in exchange for any advantage in the bidding, evaluation, contracting and implementation of the contract.

The BIDDER further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favour, any material or immaterial benefit or other advantage, commission, fees, brokerage or inducement to any official of the DSMNRU or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the contract or any other contract with the Government for showing or forbearing to show favour or disfavor to any person in relation to the contract or any other contract with the Government. The BIDDER further confirms and declares to the DSMNRU that the BIDDER is the original manufacturer/integrator/authorized government sponsored export entity and has not engaged any individual or firm or company whether Indian or foreign to intercede, facilitate or in any way to recommend to the DSMNRU or any of its functionaries, whether officially or unofficially to the award to the contract to the BIDDER, nor has any amount

been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation, as the case shall be for satisfactory performance of the proposed terms of Bidder.

The BIDDER, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payments he has made, is committed to or intends to make to officials of DSMNRU or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments. The BIDDER will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.

The BIDDER will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.

The BIDDER shall not use improperly, for purposes of competition or personal gain, or pass on to others, any information provided by the DSMNRU as part of the business relationship, regarding plans, technical proposals and business details, including information contained in any electronic data carrier. The BIDDER also undertakes to exercise due and adequate care lest any such information is divulged.

If the BIDDER or any employee of the BIDDER or any person acting on behalf of the BIDDER, either directly or indirectly, is a relative of any of the officers of DSMNRU, or alternatively, if any relative of an officer of the DSMNRU has financial interest / stake in the BIDDER's firm, the same shall be disclosed by the BIDDER at the time of filing of Bid.

#### **4) EARNEST MONEY DEPOSIT**

While submitting Technical bid, the BIDDER shall deposit an amount of Rs. .... as Earnest Money as mentioned in tender document.

The instrument for Security Deposit made shall be valid up to the specified period and the bidder shall be liable to keep the said instrument valid for such extended period as the case shall be for satisfactory performance of the terms of Bidder above referred till the complete conclusion of the contractual obligations to the complete satisfaction of both the BIDDER and the DSMNRU, including warranty period, whichever is later.

In case of the successful BIDDER a clause would also be incorporated in the Article pertaining of Performance Bond in the corresponding Contract governing such agreement that the provisions of Sanctions for Violation shall be applicable for encashment of Performance Bank Guarantee deposited towards forfeiture of said amount in case of a decision by the DSMNRU to forfeit the same without assigning any reason for imposing such sanction.

No interest shall be payable by the DSMNRU to the BIDDER on Earnest Money Deposit.

#### **5) SANCTIONS FOR VIOLATIONS**

Any breach of the aforesaid provisions by the BIDDER or any one employed by it or acting on its behalf (whether with or without the knowledge of the BIDDER) shall entitle the DSMNRU to take all or any one of the following actions, wherever required:

- i) To immediately call off the pre contract negotiations without assigning any reason or giving any compensation to the BIDDER. However, the proceedings with the other BIDDER(s) would continue.

- ii) The Earnest Money Deposit (in pre-contract stage) and/or Security Deposit / Performance Bond (Bank Guarantee) (after the contract is signed) shall stand forfeited either fully or partially, as decided by the DSMNRU and the BUYER (DSMNRU) shall not be required to assign any reason therefore.
- iii) To immediately cancel the contract, if already signed, without giving any compensation to the BIDDER.
- iv) To encash the advance bank guarantee and performance bond/warranty bond, if furnished by the BIDDER, in order to recover the payments, already made by the DSMNRU, along with interest.

**6) LAW AND PLACE OF JURISDICTION**

This Pact is subject to Indian Law. The place of performance and jurisdiction is the seat of the DSMNRU.

**7) VALIDITY**

The validity of this Integrity Pact shall be governed by the terms of the Bid No. .... towards complete execution of the contract to the satisfaction of both DSMNRU and the BIDDER/Seller, including warranty period, whichever is later. In case BIDDER is unsuccessful, this Integrity Pact shall expire after six months from the date of the signing of the contract awarding the Bidder with successful bidder.

Shall one or several provisions of this Pact turn out to be invalid; the remainder of this Pact shall remain valid. In this case, the parties will strive to come to an agreement to their original intentions.

- 8) The parties hereby sign this Integrity Pact at..... on.....

BIDDER  
Name of the Officer:  
Authorised Signatory of DSMNRU,  
Designation:

Witness:  
1.  
  
2.

Witness:  
1.  
  
2.

**Annexure -XVII**

**MANUFACTURER AUTHORIZATION FORM**

No..... dated.....

To

.....  
.....  
.....

Dear Sir:

Bid No.....

We.....who are established and reputed  
manufacturer of .....(name and  
description of goods offered) having factories at  
.....(address of factory) with factory  
registration no.....do hereby authorize  
M/s ..... (Name and address  
of Agent) to submit a bid, and sign the contract with you for the goods  
manufactured by us against the above bid.

We hereby extend our full warranty for the goods and services offered for  
supply by the above firm against this Invitation for Bid. We further certify  
that we shall support vendor with all related spares and maintenance during  
the entire contract period including the period of warranty.

Yours

faithfully,

**(Name):**.....

**(Name of manufacturers):** -----

Note: This letter of authority should be on the letterhead of the manufacturer  
or OEM and should be signed by a person competent and having the power of  
attorney to legally bind the manufacturer.

**Annexure -XVIII****EARNEST MONEY DETAILS**

| Sl.No. | Name of Laboratory/ Equipment | Earnest Money (INR) |
|--------|-------------------------------|---------------------|
|        |                               |                     |
|        |                               |                     |
|        |                               |                     |
|        |                               |                     |
|        |                               |                     |
|        |                               |                     |

**Annexure -XIX****CONTRACT FORM**

THIS AGREEMENT made on the ..... day of ..... 2020 between  
 ..... Dr. Shakuntala Misra National  
 Rehabilitation University of the one part and  
 ..... (Name & address of Supplier)  
 ..... of the other part:

WHEREAS the Purchase is desirous that certain Goods and ancillary services  
 viz. .... (Brief Description of Goods and Services) and has accepted  
 a bid by the Supplier for the supply of those goods and services in the sum of  
 ..... (Contract Prize in words and Figures) (Hereinafter called "the  
 Contract Price")

NOW THIS AGREEMENT WITNESSETH AS FOLLOWS:

1. In this Agreement words and expressions shall have the same meanings as  
 are respectively assigned to them in the Conditions of Contract referred to.

2. The following documents shall be deemed to form and be read and  
 constructed as part of this Agreement, viz.,

[a] The Price Schedule submitted by the Bidder;

[b] The Schedule of Requirements;

[c] The Terms & Conditions

[d] The Consignee's Notification of Award/ Purchase Order

3. In consideration of the payments to be made by the Consignee to the  
 Supplier as hereinafter mentioned, the Supplier hereby covenants with the  
 Consignee to provide the goods and services and to remedy defects herein in  
 conformity in all respects with the provisions of the Contract.

4. The Consignee hereby covenants to pay the Supplier in consideration of the  
 provision of the goods and services and the remedying of defects therein, the  
 Contract prices or such other sum as shall become payable under the  
 provisions of the Contract at the times and in the manner prescribed by the  
 Contract.

Brief particulars of the goods and services, which shall be supplied/  
 provided by the Supplier, are as under:

| <b>Sl. No.</b> | <b>Brief Description of Goods &amp; Services</b> | <b>Quantity to be supplied</b> | <b>Unit Price</b> | <b>Total Price</b> | <b>Delivery Terms</b> |
|----------------|--------------------------------------------------|--------------------------------|-------------------|--------------------|-----------------------|
|                |                                                  |                                |                   |                    |                       |

Total Value: Delivery

Schedule:

IN WITNESS where of the parties hereto have caused this Agreement to be executed in accordance with their respective laws the day and year first above written.

Signed, Sealed and Delivered by the  
said ..... (For the Consignee) in the  
Presence of .....

Signed, Sealed and Delivered by the  
said ..... (For the Supplier) in the  
presence of .....

**FORM - A: DELIVERY CERTIFICATE**  
(To be completed by the Consignee/Purchaser)

1. The items mentioned as per details given below, have been physically verified by way of opening the cartons/packing and verifying the machine/equipment supplied and model of the Equipments/Items. It is certified and acknowledged that the same have been received at this Institution in good condition.

| Sl. No. | Sl. No. (As per Work Order) | Description of Equipment | Origin | Model & Make | Quantity |
|---------|-----------------------------|--------------------------|--------|--------------|----------|
|         |                             |                          |        |              |          |
|         |                             |                          |        |              |          |
|         |                             |                          |        |              |          |
|         |                             |                          |        |              |          |
|         |                             |                          |        |              |          |

Please make appropriate column, as per requirement.

2. The items as per details given below was/were received in damaged conditions and therefore are not acceptable. The damaged goods/equipment has been returned to the supplier and supplier is required to supply the new equipment in lieu of damaged one.

Details of the Goods/Equipment received in objectionable condition:

| Sl. No. | Sl. No. (As per Work Order) | Description of Equipment | Origin | Model & Make | Quantity |
|---------|-----------------------------|--------------------------|--------|--------------|----------|
|         |                             |                          |        |              |          |
|         |                             |                          |        |              |          |
|         |                             |                          |        |              |          |
|         |                             |                          |        |              |          |
|         |                             |                          |        |              |          |

(Signature of the issuing official)  
Authorized Official,

Dr. Shakuntala Misra National Rehabilitation  
University

Name Designation

Rubber Seal of the Institution

**Received the Acknowledgement Certificate**

Date:.....

Signature of

Supplier or his Authorized Representative

Name:.....

**Annexure - XXI**

**FORM – B: FORM FOR ACCEPTANCE OF GOODS/EQUIPMENT AT SITE  
INSTALLATION CERTIFICATE**

(to be completed and issued by the Consignee/Purchaser)

Note: In case of need, a fresh form on these lines shall be prepared & issued by Consignee. 2 copies of this certificate to be provided to Supplier.

1. The following goods/equipment, supplied by the Supplier at this University have been successfully installed by the Supplier:

| Sl. No. | Sl. No. (As per Work Order) | Description of Equipment | Origin | Model & Make | Quantity |
|---------|-----------------------------|--------------------------|--------|--------------|----------|
|         |                             |                          |        |              |          |
|         |                             |                          |        |              |          |
|         |                             |                          |        |              |          |
|         |                             |                          |        |              |          |
|         |                             |                          |        |              |          |

2. The Supplier has fulfilled his contractual obligations related to supply & installation of the items.

Or

3. The Supplier has not fulfilled his contractual obligation with regard to following. (Mention here deviation, if any, related to successful installation.)  
(a)  
(b)  
(c)

(Signature of the issuing official)

Dr. Shakuntala Misra National Rehabilitation University

Name: .....

Designation: .....

Rubber Seal of the Institution

**Received the Acceptance Certificate**

Date:.....

Representative Name

Signature of Supplier or his Authorized

**FINANCIAL BID SUBMISSION FORM**

To,  
Registrar  
Dr. Shakuntala Misra National Rehabilitation University,

Mohaam Road, Lucknow  
Uttar Pradesh – 226017

Dear Sir,

We, the undersigned, offer to provide “SUPPLY, INSTALLATION, COMMISSIONING OF \_\_\_\_\_x\_\_\_\_\_ LABORATORY EQUIPMENT OF ENGINEERING AND TECHNOLOGY DEPARTMENT in accordance with your bid document. Our attached Financial Bid is for the amount of \_\_\_\_\_x\_\_\_\_\_ [*Indicate the corresponding to the amount(s), {Insert amount(s) in words and figures}*]. Please note that all amounts shall be the same as in Bill of Quantity (BOQ). Our Financial Bid shall be binding upon by us subject to the modifications resulting from Contract negotiations, if any, up to expiration of the validity period of the Proposal.

Yours sincerely,  
Authorized Signature {In full and initials}:  
Name and Title of Signatory:  
In the capacity of:  
Address:  
E-mail: