

TENDER DOCUMENT

**e-Tender:- “Supply of Communication Lab equipments for ECE Department ”
at IGDTUW Campus**

e-NIT no. : F.9(90)/IGDTUW/PUR/2013-14



Notice inviting Authority

Registrar

INDIRA GANDHI DELHI TECHNICAL UNIVERSITY FOR WOMEN

(Established by Govt. of NCT of Delhi under Act 9 of 2012)

Kashmere Gate, Delhi-110 006

E-mail: purchase.igit@gmail.com; www.igdtuw.ac.in

Table of Contents

Section	Contents/Description	Page No.
Section-1	Notice Inviting Tenders (NIT)	3
Section- 2	Eligibility Criteria (EMD, Minimum essential qualification, Documents etc.)	4 to 6
Section-3	Instructions to Tenderers (IT) (Validity, Cost, Bid submission, Opening, Evaluation etc.)	7 to 10
Section-4	Conditions of Contract (CC) (Performance Security, Warranty, Delivery, Payment, Penalty etc.)	11 to 15
Section-5	Schedule of Requirements & Specification	16
Annexure-1	Undertaking (Commercial capability)	17 to 18
Annexure-2	Undertaking (Technical capability)	19
Annexure-3	Manufacturers' Authorization letter.	20
Annexure-4	Technical Compliance Statement	21
Annexure-5	Check list for Technical Bid Evaluation	22
Annexure-6	Schedule of requirement and specification.	23



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SECTION- 1

NOTICE INVITING TENDERS (NIT)

1.1 Invitation for bidding

e-Tenders (online open tenders) under two bid system are invited by “**INDIRA GANDHI DELHI TECHNICAL UNIVERSITY FOR WOMEN**, Kashmere gate Delhi 11006, from eligible suppliers (manufacturers / authorized dealers) for “**Supply of Communication Lab equipments for ECE Departmentat** ” to the stores of IGDTUW on basis of free delivery at site, as per the schedule of requirements and technical specifications mentioned at **Annexure-6**, within a period of **45 days** from the date of issue of Supply order/Work order /Award of contract whichever is the earliest with the terms and conditions in this tender.

1.2 Schedule of Tenders

1	Name of work	Supply: Communication Lab equipments
2	Date of release of advertisement of tenders through e-procurement web site	02/06/2015 at 05.00 P.M.
3	Last date, time for submission of quotation/Due date and Time	23/06/2015 up to 2.00PM
4	Date& time of opening of Tender (Technical bid)	23/06/2015 at 3.00 Pm,
5	Financial bid shall be opened after evaluation of technical bid/time notified thereafter	

1.3 EMD of Rs.5,00,000 /- (Rs. Five Lakh only) in the form of DD/BC should be submitted as bid security.

1.4 The validity of bid should be 120 days from the due date of tender.

1.5 The e-procurement web site <https://govtprocurement.delhi.gov.in>. is to be used on line to avail and submit the tender documents & bids.

1.6 The place of clarification, physical submission (as per tender), and opening of bids shall be “**INDIRA GANDHI DELHI TECHNICAL UNIVERSITY FOR WOMEN**, Kashmere gate Delhi 11006

1.7 Late Tenders are not acceptable.

SECTION- 2 ELIGIBILITY CRITERIA

The Tenderer should meet the following eligibility criteria to become technically qualified.

2.1 Bid Security (EMD): To be able to secure the bid, the tenderer should submit EMD amount of Rs.5,00,000 /- (Rs. Five Lakh only) only in the form of account payee Demand Draft/Banker's Cheque drawn in favour of "**Registrar, IGDTUW GIA SB A/C**", Delhi from any nationalized bank or commercial bank. The bid security is normally to remain valid for a period of forty-five days beyond the final bid validity period. The original instrument should be submitted in physical form in a sealed envelope not bigger than A-4 size mentioning address tender ID & due date of tender in the office of Administrative Officer, "**INDIRA GANDHI DELHI TECHNICAL UNIVERSITY FOR WOMEN**, Kashmere gate Delhi 11006 before the last date & time of submission (refer section-1, clause-1.2) of this tender. Also the scanned copy of EMD is to be submitted online. The tenderer having valid NSIC / DGS&D registration for the goods / work/service required in this tender is exempted from submitting EMD. To support this, the scanned copy of such valid registration/ exemption certificate is to be submitted online.

2.2 Commercial capability

2.2.1 Terms & Conditions: The tenderer should be a manufacturer / authorised dealer for the tendered items & should not be blacklisted by any Govt. deptt. /Autonomous body/PSU etc. to become eligible for tendering. The tenderer should submit an undertaking for agreeing Terms & Conditions mentioned in all sections of this tender as per the format given at Annexure-1. The scanned copy of Annexure-1 is to be submitted online.

2.2.2 Minimum Financial Turnover: The tenderer should have supplied similar kind of goods/work/service after April, 2011 onwards. The tenderer should submit an undertaking duly filled in the Annexure-1 to this effect. In support, the tenderer should submit online the scanned copies of audited accounts showing Annual financial turnover for the last three years (2011-12, 2012-13 and 2013-14). In this tender, the definition of 'similar kind of goods/work/service' is 'supply, installation & commissioning of Lab/office machinery/equipments required for Technical Training Institutes / Universities / Colleges /Govt. deptts. / Autonomous Institutions /PSU organizations'.

2.2.3 Minimum Work experience: The tenderer in past (starting April, 2011 up to date) should have the experience of successful completion of (i) Three similar nature of works each costing not less than the amount equal to Rs. 25,00,000/- (Rs. Twenty Five lakh). The tenderer should submit an undertaking duly filled in the Annexure-1 to this effect. In support, the tenderer should submit online the scanned copies of the 'work order copies with work completion certificates'. In this tender, the definition of 'similar kind of goods/work/service' is 'supply, installation & commissioning of Laboratories required for Technical Training Institutes / Universities / Colleges /Govt. deptts. / Autonomous Institutions /PSU organizations'.

2.2.4 The tenderer should submit online the scanned copies of latest valid I.T.R (Income tax Return) and VAT/Sale tax /service tax return.

2.2.5 Tenderer should submit signature authorization certificate duly filled in Annexure - 1.

2.3 Technical capability

2.3.1 The tenderer should submit an undertaking in the format given at Annexure-2. The tenderer should be sound in terms of manufacturing facility/ Supplying & Servicing capability, Quality control measure, Inspection facility, installation, commissioning, providing after sale service, warranty facilities, experience & past performance to do the work satisfying the required specifications. The company/product with valid **BIS or ISO certification** shall be mandatory to qualify technically. To fulfil this, Tenderers should submit online the scanned copy of the certificate.

2.3.2 The tenderer should submit online the scanned copy of the Manufacturer's Authorization Letter, as applicable, as per Annexure-3.

2.3.3 The tenderer should submit online the scanned copy of the 'Technical Compliance Statement' as per Annexure-4.

2.3.4 The tenderer should submit online the scanned copy of the 'Check list for Technical evaluation' as per Annexure-5.

2.3.5 The tenderer should submit in physical form any leaflet/catalogue/Literature/specification sheet/photograph/drawings/sketches etc. in support of their product / service & specifications in the sealed envelope meant for submitting original instrument of EMD (refer section-2, clause-2.1).

2.4 Original documents: The tenderer should submit only following original documents in physical form before the due date & time of this tender no other documents shall be entertained except following.

2.4.1 Original instrument of EMD (As per clause-2.1).

2.4.2 Original copy of leaflet / catalogue /Literature/ specification sheet /photograph/Drawings/Sketches etc. (As per clause-2.3.5)

2.5 Scanned copies of documents: The tenderer should submit online the scanned copies of the following documents duly filled & signed before the due date & time of this tender. The scanned copies should be clearly visible & readable.

2.5.1 Scanned copy of EMD or valid EMD Exemption certificate (As per clause-2.1).

2.5.2 Scanned copy of latest valid return of ITR (As per clause-2.2.4).

2.5.3 Scanned copy of latest valid return for VAT/Sale tax/service tax (As per clause-2.2.4).

2.5.4 Scanned copies of audited accounts showing Annual financial turnover for the last three years (2011-12, 2012-13 and 2013-14) (As per clause-2.2.2).

2.5.5 Scanned copies of Annexure 1, 2, 3, 4 & 5 duly filled and signed (As per clause-2.2.1, 2.3.1, 2.3.2, 2.3.3, 2.3.4 respectively).

2.5.6 Scanned copy of BIS or ISO certification (As per clause- 2.3.1).

2.5.7 Scanned copies of the work order copies with work completion certificates (As per clause-2.2.3).

2.6 Rejection of bid: The tender is liable for rejection at any stage during evaluation due to any of the reasons mentioned below.

2.6.1 Minimum Financial Turnover: The tenderer fails to meet the criterion of annual average financial turnover during the last three financial years (2011-11, 2012-13, 2013-14) as per clause-2.2.2.

2.6.2 Minimum work experience: The tenderer fails to meet the criterion of minimum work experience as per clause-2.2.3.

2.6.3 Certification: The tenderer fails to meet the criterion that the company/product should have valid BIS/ ISO certification as per clause-2.3.1.

2.6.4 Conditional bids: The tenderer submits a conditional bid document or submits an extra document other than those mentioned in clauses-2.4 & 2.5. Conditional bid shall be rejected. Tenderers should note that 'No Price should be indicated in the Technical Bid'. In case any price is mentioned in the technical bid, the Bid will be rejected outrightly without any further correspondence.

2.6.5 Incomplete bids: : It is found that there is submission of incomplete, unsigned and uncertified bid document **or** Non-submission of tender within stipulated time **or** Submission of tender documents in unsealed envelope **or** Tender envelopes which are not super scribed with details of the tender ID/enquiry **or** Non-payment of Earnest Money Deposit (if not exempted) **or** Non-submission of required documents as shown in clause 2.4 & 2.5 **or** Submission of misleading / contradictory / false statement or information and fabricated / invalid documents.

2.6.6 Physical hard copy: Only e-tender shall be accepted & considered. In no case physical hard copy of tender shall be accepted except EMD as per clause 2.1 and any leaflet / catalogue /Literature/ specification sheet /photograph/Drawings/Sketches etc. as per clause-2.3.5.

N.B:- Competent Authority, IGDTUW, reserves the right to accept or reject any tender without assigning any reason or to cancel the tendering process and reject all tenders at any time prior to award of contract without incurring any liability, whatsoever to the affected tenderer or tenderers and can take appropriate action as per Govt. rules.

SECTION-3 INSTRUCTIONS TO TENDERERS (IT)

3.1 Introduction & Eligibility: Definitions and abbreviations which have been used in these documents shall have the meanings as indicated in the Section-4 (Condition of contract). This Tender Document comprises of contents as mentioned in the 'table of contents' & is as per guidelines of Finance Deptt, Govt. of NCT of Delhi. This section provides the relevant information, terms & conditions, procedure for tendering, opening of bid, evaluation, award of contract etc. However, the tenderers should also study and examine all the terms & conditions in rest of this tender document including eligibility criteria, CC, Undertakings & Annexures etc. before submitting the tenders. The tender submitted by the tenderer, all subsequent correspondence exchanged between the tenderer and the University and documents related to the tender, shall be written in English language only. The tenderers are instructed to ensure that they conform to the eligibility criteria as prescribed in section-2 before submitting the offer/tender.

3.2 The validity of bid should be **120 days** from the due date of tender.

3.3.1.1 The estimated cost of the goods/work/service is **Rs. 1,90,05,188(One Crore Ninety Lakhs Five Thousands one Hundred Eighty Eight Rs. Only)**

3.4 Quoting of rate: The tenderers are instructed to refer section-4 (conditions of contract) including price bearing elements before quoting rates/price. The tenderer should quote fixed prices/rates and should be at par with the prices quoted by it to any other department of Govt. of India/Govt. of NCT of Delhi/ Institutions/University.

3.5 Tender Sample Inspection: the tenderer must be capable of providing samples of the goods to be procured at IGDTUW; or at its factory; or at the place desired by the Technical Committee, if required, for inspection. The Technical Committee, if required, may visit the factory of the bidder to assess the capabilities and the quality of the goods to be procured during the tender processing as well as during supply.

3.5.1. The eligibility of firm shall further subject to satisfactory demonstration of product in front of Technical committee constituted by the University for this purpose.

3.6 Clarification before bidding: prospective tenderers can obtain Clarification to clear any doubt before bidding. from Technical Committee / Authorized Committee in the office of Administrative Officer , IGDTUW,Kashmere Gate Delhi-10006 .

3.7 Amendments to the Tender documents: Registrar, IGDTUW / Authorized Officer of IGDTUW, at any time prior to the deadline for submission of tenders may, for any reason deemed to be fit, modify the tender documents by issuing amendments. Such an amendment will be notified in writing.

3.8 Preparation of Tenders

3.8.1 Availability of Tender Documents: Tender documents are available on the web site <https://govtprocurement.delhi.gov.in>. Prospective tenderers can access the same and they can download the tender documents, free of cost.

3.8.2 Technical Bid (TB): Tenderers should submit / upload technical bid containing original & essential requisite documents as per guidelines mentioned in Section-2, of this tender. **It should not contain any price.**

Tenderers should quote one model per tender. To submit tenders for more than one model, separate tenders with separate EMD's will have to be submitted / uploaded.

3.8.3 Financial Bid (FB): 3.8.3.1 The bidder shall quote unit rate in INR, both in word and figures in the Financial Bid only. No alterations in the form of tender, in the schedule of quantities or additions etc. shall be permitted. In case of difference between the rates of items written in figures and in words, the rates of items written in words shall be taken as correct. No changes in unit rates shall be allowed. The rates quoted in schedule quantity are for finished and completed items and no extra amount for carting or transporting material, labour etc. shall be paid unless specifically so mentioned or provided for in tender. The rates should be inclusive of all leads and lifts for all materials in the completed items and also include all taxes, duties, royalties etc. including Work Contract Tax, labour cess, ESI, EPF etc. as applicable. No extra payment on this account will be made.

3.8.3.2 Income Tax/DVAT /TDS shall be deducted at source at the rate that will be in force from time to time.

3.8.3.3 The bidder shall quote unit rate in INR, both in word and figures in the Financial Bid only.

3.8.4 Earnest money Deposit (EMD): Tenderers should submit EMD in INR only as prescribed. No interest shall be payable by the University on the EMD. EMD will be returned to the successful tenderers after receipt of Performance security. Bid securities of the unsuccessful bidders shall be returned to them at the earliest after expiry of the final bid validity.

3.8.5 Undertaking for acceptance of terms & conditions: Tenderers should submit an Undertaking certifying that they accept all terms & conditions mentioned in this tender document in the format at Annexure-1 as per instruction given in section-2.

3.8.6 Authorization to sign and submit the tenders: The individual signing the tender or any other documents connected therewith should clearly indicate his full name and designation and also specify whether he/she is authorized signatory as per undertaking in Annexure-1.

3.9 Submission of Tenders

3.9.1 Registration: The prospective tenderer should be registered with Govt. of Delhi's e-Procurement Portal and should have Digital Signatures & proper training etc., to enable him to submit bids on-line through e-Tendering. For any assistance/training regarding registration & e-tendering, the intending tenderer may contact officials as referred in the website mentioned in clause-3.8.1.

3.9.2 Document file: Once the tenderer agrees to the terms & conditions of the tender, submission process can be started. The total size of all documents in all the covers put together should be less than 10 MB. The bidders are advised to scan the documents in low resolution (75 to 100 DPI) to reduce the size of the cover to facilitate uploading of all the required pages. If the documents could not be opened due to virus, during tender opening, or if incomplete page/document is opened in incomplete form, then the bid is liable to be rejected. Proper training shall help in proper submission.

3.10 Alteration and Withdrawal of tender: The e-tender system allows the tenderer to alter/modify/withdraw the tender only within the deadline for submission of tenders. Alterations/modifications to tenders after the prescribed deadline will not be permitted by the system.

3.11 Opening of Bids: The tenders will be opened in the office of Administrative Officer, Indira Gandhi Delhi Technical University for Women, Kashmere Gate Delhi-110006 by a tender opening committee of IGDTUW (DSC holders for e-tenders & purchase committee for tenders other than e-tenders) on date & time as specified under Section-1. The downloadable documents, original documents & submitted documents shall be compiled & attested by the bid openers and presented for evaluation to the competent Purchase Committee/authority.

In case the specified date of tender opening falls on a holiday or declared closed or any unforeseen technical problem in the computer system/server/networking occurs, then tenders will be opened on the appointed time and place on the next working day.

Authorized representatives of the tenderers, who have submitted tenders in time, may attend the online tender opening process, on production of letter of authority from the concerned tenderers or they can view the process on-line & the result will be informed online. During the tender opening, the tender opening committee may inform tenderers regarding number of uploaded tenders, name of the companies and any other special features, as deemed fit.

3.12 Scrutiny and evaluation of Tenders: The technical bids shall be scrutinized and evaluated by the competent Purchase Committee/authority with reference to the parameters prescribed in the tender document including section-2. No new condition will be brought in while scrutinizing and evaluating the tenders.

3.13 Clarification of Bids: During evaluation and comparison of bids, the University may, at its discretion, ask the bidder for clarification on the scanned documents uploaded by them. The bidder should submit written clarification/documents within the stipulated time. The University may accept such clarification and receive documents related to the clarification sought. No change in prices or substance of the bid shall be sought, offered or permitted. No post-bid clarification at the initiative of the contractor shall be entertained.

3.14 Cartel formation/Pool Rates: Cartel formation or quotation of pool/co-ordinated rates leading to “Appreciable Adverse effect on Competition” (AAEC) as identified in Competition Act, 2002, as amended by Competition (Amendment) Act, 2007, would be considered as a serious misdemeanour and would be dealt accordingly as per the Section-4.

3.15 Negotiations: Normally, there would be no negotiation including price negotiation after financial bid opening. But the Competent Authority, IGDTUW, reserves its right to negotiate with the lowest acceptable contractor (L1) under special circumstances in accordance with CVC guidelines before award of contract/order.

3.16 Award of Contract

3.16.1 Contract Award criteria: An order/contract will be awarded to the lowest evaluated responsive Tenderer (L-1 tenderer) on the terms and conditions laid down in this tender/negotiated as per rule before notification of award of contract/order.

Competent Authority, reserves the option of giving purchase/price preference to the offer from Central / State Government Public sector undertakings in accordance with the policy of Govt. of India.

3.16.2 Notification of award / Acceptance of offer: Before expiry of the validity of tenders, Indira Gandhi Delhi Technical University for Women, Kashmere Gate Delhi 110006 will notify the successful tenderer in writing that its tender for supply of goods/work/service has been accepted.

The successful tenderer should respond satisfactorily as prescribed in the notification within 15 days from the date of issue of the letter of notification of award by the University sent by speed post to the address mentioned in its bids.

The communication of notification of award sent by University to the successful tenderer shall be treated to be complete as against the tenderer where it is put in the transmission to him/her so as to be out of the power of the Institute. The responsibility entirely lies on the tenderer to collect the letter of notification of award released by the University & respond to it. Until a formal contract is executed, this tender with written acceptance from purchaser thereof shall constitute a binding contract between the parties.

3.16.3 Conclusion of contract: The successful tenderer must furnish the required performance security within **15 days** from the date of issue of notification of award as per Section-4 to conclude the contract.

3.16.4 Safety and Security

Safety and Security of workers/staff, material, equipments, etc. will be the responsibility of the contractor. The university will not be held responsible on this account.

The University reserves the right, without being liable for any damages or obligation to inform the bidder, to:

(a) Amend the scope and value of contract to the bidder.

(b) Reject any or all the applications without assigning any reason.

Any effort on the part of the bidder or his agent to exercise influence or to pressurize the University would result in rejection of his bid. Canvassing to any kind is prohibited.

SECTION-4 CONDITIONS OF CONTRACT (CC)

4.1 Definitions, Interpretations and Abbreviations: Terms and expressions not herein defined shall have the meanings assigned to them in the Indian Contracts Act, 1872 (as amended)/the Indian Sale of Goods Act, 1930 (as amended)/the General Clauses Act, 1897 (as amended)/GFR-2005/ guidelines by Finance Deptt. Govt. of NCT of Delhi as the case may be. University/IGDTUW means Indira Gandhi Delhi technical University for Women , cashmere gate Delhi-. Supplier/contractor means successful tenderer as mentioned in notification of award.

4.2 Definition of Contract & other terms: (a) "Contract" means the invitation to tender, instructions to tenderers, tender, acceptance of tender, particulars & the conditions specified in the acceptance of tender. No variation in the terms of a "concluded contract" can be made without the free consent of the parties. (b) "Acceptance of Tender" means the letter of notification of award by purchaser communicating to the contractor the acceptance of his tender.

4.3 Authority: Registrar & Competent Authority is referred to those of IGDTUW. The Purchaser, Indenter, Consignee, End user, Inspection authority & Paying authority shall be the respective Officers / Committees duly authorized by the Competent Authority of IGDTUW.

4.4 Performance Security (in Indian Rupees only): The successful bidder have to submit a Performance Security Deposit @ 10% of the quoted value (validity : warranty period + two months) in the form of Bank Guarantee /FDR drawn in favour of "**Registrar, IGDTUW GIA SB A/C**" Delhi within 15(Fifteen) days of the communication accepting the bid. EMD of successful bidder shall be refunded after submission Performance Security Deposit. The Performance Security Deposit shall be refunded without interest after completion of the guarantee period +two months.

4.5 Price bearing elements

4.5.1 Scope of supply of goods/work/service: The goods/work / service along with quantity to be supplied by the contractor under this contract shall conform to the technical specifications and quality control parameters mentioned in Section-5 "Schedule of Requirement & specification" of this tender document.

4.5.2 The quoted rates shall be in Indian Rupees only on the basis of free delivery at stores of IGDTUW, Kashmere Gate, Delhi, which are inclusive of appropriate packing, marking, forwarding, transit insurance, transportation, loading, unloading, installation & commissioning charges, training, after sale service, Repair/ replacement of defective parts during warranty period etc. Amount of any local taxes / VAT etc. should be indicated separately in the tender. All applicable Govt. deductions like ESI, TDS etc. shall be applied at prevailing rates, if applied.

4.5.3 Imported goods: If the goods are to be imported, the contractor will import the same by paying all incidental charges & duties (customs duty etc.) and supply the goods to the indenter. However, applicable local taxes will be paid by the indenter, if quoted.

4.5.4 Firm Prices: Prices quoted by the contractor shall remain firm and fixed during the currency of the contract.

4.5.5 Fall Clause: If at any time during the execution of the contract, the price of the ordered goods/Work/service, are reduced, in respect of supplies to any Govt. organization (including the purchaser of any department of the Govt. of N.C.T. of Delhi) at a price lower than the price quoted under this contract, the contractor shall immediately inform and forthwith pass such reduction to the purchaser. The price of such item, payable under this tender for the goods/Work/service supplied after the date of coming into force of such reduction, shall stand correspondingly reduced.

4.5.6 Tolerance clause: Competent Authority of IGDTUW reserves the right to increase or decrease the items / procurement / quantity within plus/minus 15% of tendered items without any change in terms & conditions & quoted price at any time before conclusion of contract without assigning any reason.

4.5.7 Other factors like term of & period of delivery, warranty / guarantee clause & free incidental services etc. that also have bearing on prices are prescribed in the following clauses.

4.6 Delivery of goods /work/service

4.6.1 Terms of delivery: The quoted rates shall be in Indian Rupees only on the basis of free delivery at sites of IGDTUW, Kashmere Gate, Delhi.

4.6.2 Advance Sample: The contractor shall initially deliver a sample item and get it approved by IGDTUW preferably within **30 days** from the date of issue of supply order/work order /award of contract before delivering the balance lot.

4.6.3 Delivery, period & schedules: The delivery of complete goods/work/service in all respects as per order/contract should be made to the concerned store of this University on basis of free delivery at site within **45 days** from the date of issue of supply order/work order /award of contract whichever is the earliest. The contractor shall not arrange part-shipments and trans-shipments without permission of IGDTUW. The Insurance cover including insuring the goods against loss or damage incidental to manufacture or acquisition, transportation, storage and delivery/commissioning shall be obtained by the contractor in his own name and not in the name of the Consignee. The Consignee will as soon as possible but not later than 30 days from the date of arrival of goods at destination notify the contractor of any loss or damage to the goods that may have occurred during transit. The date of delivery of goods/work/service stipulated in the order/contract shall be deemed to be the essence of the contract and delivery must be completed before the date of delivery as specified in the supply order/ work order/award of contract.

4.6.4 Actual date of delivery: The date of satisfactory completion of work duly accompanied by certified good receipt note & certificate of completion will only be considered as the actual date of supply/date of delivery of goods/work/service. Part supplies except the samples are not acceptable. The delivery will not be deemed to be completed until and unless goods/work/service are inspected & accepted by the Consignee /end user /Inspecting Authority of IGDTUW with Product information brochure and or Users/operating manual (two copies) supplied with goods/work/service, wherever applicable.

The Competent Authority, IGDTUW reserves the right to reject supplied goods/work/service which do not conform to the tendered specification or received after date of delivery to safeguard Government interests and in the interest of University.

4.7 Assignment / Sub-contracts: The contractor shall not assign either in part or whole its contractual duties/responsibilities and obligations to perform the contract to any third person and in all cases, the responsibility of fulfilling the contractual obligations will remain with the contractor only.

4.8 Incidental services: The supplier will provide required jigs & tools, operation manuals, installation, Commissioning, training & after sales service & Warranty/guarantee etc.

4.9 Warranty/guarantee: The contractor shall certify that the goods/ work /service supplied to the Purchaser under this Contract are of best quality and workmanship and new in all respects and are strictly in accordance with the specifications and particulars mentioned under Section-5 “Schedule of Requirement & specification”. Comprehensive Warranty/guarantee is for two (2) years from the date of successful commissioning of the complete work & shall cover each and every part of the item including consumables, parts having limited life and non-consumable parts etc. The University is not liable to pay any charges on any account during the warranty period. The contractor shall pay to the Purchaser such compensations that may arise by reasons of the warranty therein contained but not attended by the contractor.

4.9.1 The maximum response time for maintenance complaint during warranty period (i.e. time required for bidder’s maintenance engineer to report at the installation after a request call/e-mail or letter is written) shall not exceed 01 day.

4.9.2 The period for correction of defects in warranty period is 03 days.

4.9.3 In case an item is not usable beyond the stipulated maximum downtime the contractor will be required to arrange for an immediate replacement.

4.9.4. In case the rectification of defects is not carried out within 03 days and replacement of defective items are not provided, a penalty of sum equivalent to 5% per week of the delivered price of that defective item(s) shall be levied. This penalty is applicable up to a maximum of 4 weeks (maximum 20%). Subsequently, the rectification shall be carried out by the University at the risk and cost of the contractor. The cost of repairs along with the penalty of 100% shall be recovered from the payment with held with University and the balance amount if any, will be paid to the contractor after completion of warranty obligations.

4.10 Payment terms: 100% Payment shall be made after receipt of complete goods/work/service, subject to due inspection, installation, successful commissioning and take over by the consignee/end user. The contractor has the entire responsibility of collecting/receiving satisfactory completion report from the end user and submitting it along with bills in triplicate at the paying authority. The payments shall be made in the currency authorized in the contract. No advance payment shall be made.

4.11 Amendment / modification of contract: If necessary, the purchaser may notify the contractor regarding modification / amendment of terms & conditions of the contract, by a written order not amounting to either increase or decrease in the accepted prices.

4.12 Default/Delay/penalties

4.12.1 Default after opening of tenders: EMD of tenderer will be forfeited in case the tenderer withdraws/ modifies / alters / amends its tender or impairs or derogates from the tender in any respect after the due date of tender & within the period of validity of tenders.

4.12.2 Default after notification of award of contract: EMD of successful tenderer will be forfeited in case (i) The successful tenderer does not furnish Performance security within prescribed time as per tender terms & notification of award of contract or (ii) the successful

tenderer responds to the notification of award without performance security but with a fresh condition/terms other than the ones in the tender/negotiated as per rule before such notification or (iii) Submission of misleading / contradictory / false statement or information and fabricated / invalid documents is detected after notification of award of contract/order. (In case of registered contractor with DGS&D / NSIC having exemption from EMD, the Institute may impose a penalty including cancellation of registration and/or blacklisting the contractor as per rule, depending upon urgency of requirement as per final decision by the Competent authority, IGDTUW)

4.12.3 Default after furnishing of Performance security: In the event of any loss to the purchaser, due to contractor's failure to fulfil the contractual obligations etc., the performance security will compensate the loss i.e. the Competent Authority, IGDTUW will deduct the amount from performance security and release the balance amount as stipulated.

Submission of misleading/false document: The Performance Security of the contractor will be forfeited with termination of contract if submission of misleading / contradictory / false statement or information and fabricated / invalid documents is detected after award of contract/order.

For Non-supply of goods/work/service: The Performance Security of the contractor will be forfeited with termination of contract If neither supply has been made nor prior extension of date for supply has been obtained. The University may procure the goods/work/service on Risk purchase basis at the cost of contractor. The Institute may also impose a penalty and/or blacklist the Contractor, depending upon urgency of requirement as well as the loss of revenue due to non-availability of such store. The time period for making risk purchase shall be 3 months.

For delayed supply of goods/work/service: The delayed supply of goods/work/ service, for which prior approval for extension of date for supply has not been obtained, will be accepted only with penalty. The Competent Authority reserves the right to levy liquidated damages equivalent to 0.5 % of the price of the delayed goods/work/service per week which will be charged / deducted according to the delay in supply of the goods/work/service beyond expiry of the supply period subject to a maximum of 10% of the total value of the order.

Due date extension request: In case, the supply of goods/work/service cannot be delivered within the due date of delivery, the contractor shall have to obtain a prior permission for extension from the Competent Authority , IGDTUW. However, the extension of date of delivery is admissible only with penalty as per rule. In special circumstances, extension may be granted by the Competent Authority , IGDTUW without penalty.

4.12.4 Termination for Insolvency: If the contractor becomes bankrupt or otherwise insolvent, the Institute, reserves the right to terminate the contract at any time, by serving written notice to the contractor without any compensation, whatsoever, to the contractor, subject to further condition that such termination will not prejudice or affect the rights and remedies which have been accrued and / or will accrue thereafter to the University.

4.12.5 Force Majeure: In the event of any unforeseen circumstances directly interfering with the supply of goods/work/service arising during the currency of the contract, such as war, hostilities, acts of the public enemy, civil commotion, sabotage, fires, floods, explosions, epidemics, quarantine restrictions, strikes, lockouts, or acts of God, the Contractor shall, within a week from the commencement thereof, notify the same in writing to the Purchaser with reasonable evidence thereof. Either party shall have the option to

terminate the contract on expiry of 90 days of commencement of such force majeure by giving 14 days' notice to the other party in writing. In case of such termination, no damages shall be claimed by either party against the other, except those which had occurred under any other clause of this contract prior to such termination.

4.13 Code of ethics: The Institute, as well as the Bidder / Contractors / Manufacturers / Authorised Supplier under the contract shall observe the highest standard of ethics including laws against fraud and corruption in force in India namely "Prevention of Corruption Act 1988", during the procurement or execution of such contracts. If the tenderers /contractors are found in Bid pooling or against law against fraud and corruption then their firms may be black listed.

4.14 Resolution of disputes/arbitration/jurisdiction: In case of any difference/dispute between the University and the contractor arising relating to the contract, the parties shall make every effort to resolve the same amicably by mutual consultations. If the Parties fail to resolve within 21 days of its occurrence, then either party may seek to refer the dispute for sole arbitration by any person to be nominated by the Competent Authority, Indira Gandhi Delhi Technical University , Kashmere Gate , Delhi. The award of the arbitrator so appointed shall be final and binding on both the parties. However during the arbitration proceedings the parties shall not delay or postpone the performance of their respective obligations pursuant to the contract. The courts of place from where the notification of award is issued shall alone have the jurisdiction to decide any dispute, court jurisdiction shall be Delhi.

SECTION-5
SCHEDULE OF REQUIREMENT & SPECIFICATION
LIST OF REQUIREMENTS:

5.1 Scope of supply of goods/work/service: The list of Requirement along with technical Specification of the goods/work/service is given in the Annexure-6.

5.2 Technical compliance: The tenderer should submit a technical compliance statement clearly indicating the deviations (if any) in the prescribed format given under Annexure-4.

5.3 Quality parameters: With reference to the specifications as per Annexure-6, the Quality, dimensions, adequate fittings, fasteners, weather proofing, edge blunting, aesthetic look, surface finish, injury proof, surface treatment including painting, appropriate packing, proper identification marking of goods including samples are the broad parameters of quality to manufacture, check, test & comply with in line with national/international standards. The Inspection authority/Technical committee of the University shall be the final authority to issue the certificate of compliance of the technical requirement.

Annexure-1
Undertaking (Commercial capability)
(To be submitted in Technical bid)

Tender ID Due date 23/06/2015 upto 2:00 PM

Sir,

I/we undertake, certify & declare the following-

1. We have carefully read and understood all terms and conditions/instructions elaborated in all the sections including IT, CC & annexure of this Tender document and we shall abide by them. Also our organization is not blacklisted by any Govt. Department/ Autonomous body/PSU etc.

2. We are the(manufacturers / authorized suppliers) (tick appropriate option) of the goods/work/service required as per this tender document & our Annual average financial turnover during the last three financial years (2011-12, 2012-13, 2013-14) in the books of accounts is Rs.....

3. As per clause-2.2.3 following are the details of three similar natures of works with cost not less than the amount equal to 40% of the estimated cost of this tender items, which we have executed successfully.

S. No.	Name of Customer/ Address/ phone	Cost (in Rs.)	Brief description of work done
1			
2			
3			

4. Our valid
i) TIN No. is.....valid upto.....
ii) PAN No. is.....valid upto.....
iii) Service Tax No. is.....valid upto.....
Latest ITR return is filed in the name of.....

5. Latest VAT/Sales tax return/Service tax return is filed in the name
of.....

6. The name of Proprietor is Mr./Ms.....

7. We authorize Mr./Ms.....having designation of
.....to sign this offer/tender.

.....
.....

(Signature with date, name and designation)

For and on behalf of M/s.....

(Name, Address & Telephone No & seal of the Tenderer

Annexure-2
Undertaking (Technical capability)
 (To Be Submitted in Technical Bid)

Tender ID:

Due date 23/06/2015 upto 2:00 PM

Sir,

I/we undertake, certify & declare the following-

1. If our tender is accepted, we undertake to supply the goods/work/service with required specification and perform the services in accordance to the terms & conditions in this tender document including the delivery schedule.

2. Our company/product has.....Certification. (BIS/ISO)

(Tick the appropriate option).

3. The details of our local service facility nearest to Delhi/New Delhi/NCR is

.....

(Responsible person, Name, Complete address, telephone no's, e-mail I.D. etc.)

4. The tentative schedule of training (if any) is.....

5. The details of Mode of despatch are.....

6. The details of instructions for special preparation for installation (if any) are.....

7. Our details of Infrastructures are as follows-

S.No.	Parameter	For “Manufacturer”	For “Non-Manufacturers”
1	No. of personnel employed		
2	Manufacturing facilities		
3	Quality control systems		
4	After-sales-service facilities		
5	Any other information		

.....

(Signature with date, name and designation)

For and on behalf of M/s.....

(Name, Address & Telephone No & seal of the Tenderer)

Annexure-3
Manufacturer's Authorization Letter
(To Be Submitted in Technical Bid on the Manufacturer's Letter Head)
Tender ID: **Due date 23/06/2015 upto 2:00 PM**

Yours faithfully

.....
.....

(Signature with date, name and designation)

For and on behalf of M/s.....

(Name, Address & Telephone No & seal of the Tenderer)

Annexure-4
Technical Compliance Statement
 (To Be Submitted in Technical Bid on Letter Head)
Tender ID: **Due date 23/06/2015 upto 2:00 PM**

Note:

Tenderer should indicate “Yes, meets” OR “No, doesn’t meet” under appropriate columns in the Technical Compliance Statement.

S.No.	Tender Technical Specifications	Specifications of the Work Item offered by the Tenderer	Whether the Offered Work item meets Tender Specifications or not	Deviation(s) from Tender Specifications, if any (in unambiguous Terms)
1				
2				
3				
4				
5				
6				

Yours faithfully

.....

(Signature with date, name and designation)

For and on behalf of M/s.....

(Name, Address & Telephone No & seal of the Tenderer)

Annexure-5
Checklist for Technical Bid Evaluation
 (To Be Submitted in Technical Bid)

Tender ID: _____ **Due date** 23/06/2015 upto 2:00 PM
 (Note: Please ensure that the following requirements are complied with)

S. No	Information to be provided	To be filled by the Bidder		For office use
		Fill particulars	Reason for not filling	
1	Original instrument of EMD No. Dated.of Amount Rs is submitted in physical form	Yes/NO		
2	Leaflets/Catalogues/literature/photographs /Drawings/Sketches for products as per clause- 2.3.5 in physical form are submitted			
3	Scanned copy of EMD/exemption certificate is submitted			
4	Scanned copy of BIS/ISO certification is submitted			
5	Scanned copy of latest Income Tax Return (ITR) is submitted			
6	Scanned copy of latest VAT/Sale tax/service tax Return is submitted			
7	Scanned copies of audited accounts Showing Annual financial turnover for the last three years (2011-12,2012-13,2013-14) is submitted			
8	Scanned copies of 'Work Orders with work completion certificates' as per clause-2.2.3 are submitted			
9	Scanned copies of Annexure 1,2, 3, 4 & 5 duly filled and signed are submitted			
10	Average Annual turnover for last 3 years ending March 2014 is Rs.& submitted			
11	Minimum Work experience criteria as per clause- 2.2.3 is met			

Note: Original copies of all requisite documents must be produced for verification of the information provided whenever called for.

Yours faithfully

.....

(Signature with date, name and designation)

For and on behalf of M/s.....

(Name, Address & Telephone No & seal of the Tenderer)

Annexure-6
Schedule of requirement & Specification

Note: This Annexure need not be submitted (only for reference)

Name of work: Supply of Communication Lab equipments for ECE Departmentat

Sr. No	Specifications	Qty	Unit Price in figure (inclusive taxes)	Unit Price in words Amount (inclusive taxes)
01.	<p><u>Amplitude Modulation (SSB/DSB) Transmitter Trainer</u> On board Functional blocks with self explanatory waveforms and technical details indicated . Oscillator controlled carrier frequency ; LED indication for signal flow and selection At least 25 nos. gold plated test points for waveform observation At least 8 Switched faults for troubleshooting at different functional blocks Telescopic antenna should be provided for transmission of AM signal On board audio jacks should be provided for Microphone and Earphone connection. On board Speaker provided for audio communication Audio Oscillator : Adjustable Amplitude & Frequency (300 Hz - 3.4 KHz) Audio Output : Amplifier with speaker Modulators : Balanced Modulator with Band pass Filter (1 MHz) - 2 nos. Balanced Modulator : 1 No. (455 KHz) Ceramic Band pass Filter : 1 No. (455 KHz) Carrier Frequency : 1 MHz (Oscillator controlled) Transmitter Amplifier Output: (Gain adjustable) DSB (1 MHz), SSB (1.445 MHz) connected to Antenna/cable Antenna: Telescopic with Radiation distance up to approx. 1 meters Switched Faults : 8 nos. Test points: 27 (Gold Plated) ; Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated Power Supply : 110-220 V AC $\pm 10\%$, 50Hz Accessories Included :Line Cord , , Set of patch Cord , E manual Cabinet Housing : Enclosed on a plastic box with a cover No components on the top of the Trainer only block diagram to be provided Software: Single user License , Teaching & Simulation Software for Analog communication with simultaneous display of waveform in time & frequency domain. with full theory & diagrams Hardware Lock should be provided with it.</p>	<u>20</u>		
02.	<p><u>Amplitude Demodulation (SSB/DSB) Receiver Trainer</u> On board Functional blocks with self explanatory waveforms and technical details indicated. On board Tuner provided for tuning the transmitting station LED indication for signal flow and selection At least 30 nos. gold plated test points for waveform observation and analysis 8 Switched faults for troubleshooting at different functional blocks Telescopic antenna for reception of AM signal On board audio jack provided for Earphone connection On board Speaker provided for audio communication Construction : Superhetrodyne Frequency Range :980 to 2060 KHz Intermediate Frequency :455KHz ;Input Circuit:1. RF amplifier 2. Mixer 3 Local oscillator 980 to 2060 KHz 4. Beat Freq. Oscillator 5. IF Amplifier 6. IF Amplifier 2 Tuning :Variable capacitor(Ganged) Dial marking on board : Range 525 to 1600 KHz Receiving Media :Telescopic Antenna/ Cable Detectors :1). Diode Detector (DSB) 2.) Product Detector (SSB) Audio Output :Amplifier With Speaker/ Headphone Switch able Automatic Gain Control ,Switched Faults:8 Nos. Test points: 30 (Gold Plated) ; Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated Power supply : 110-220 V AC $\pm 10\%$, 50Hz Accessories Included :Line Cord , Manuals, Set of patch Cord , E manual Cabinet Housing : Enclosed on a plastic box with a cover No components on the top of the Trainer only block diagram to be provided Software: Single user License , Teaching & Simulation Software for Analog communication with simultaneous display of waveform in time & frequency domain. with</p>	<u>20</u>		

	full theory & diagrams Hardware Lock should be provided with it.			
03.	<p>FM Modulation & demodulation Trainer</p> <p>Audio Oscillator: with adjustable Amp. & Freq. (300Hz to 3.4 KHz) FM Modulators : 2Nos. Reactance Modulator (With Carrier Frequency Adjustment) Varactor Modulator (With Carrier Frequency Adjust) Mixer/Amplifier : 1 No. (with Gain Adjustment) Allows FM Input to be Amplitude Modulated by Noise Input Prior to demodulation using any external noise source Transmitter O/P Frequency : 455KHz FM Demodulator :1, Detuned Resonant Detector 2, Quadrature Detector 3, Foster Seeley Detector 4, Ratio Detector 5, Phase Locked Loop Detector Low Pass Filter/ Amplifier :3.4 KHz cutoff Frequency (with gain adjust) Amplitude Limiter : 1 No. Switched Faults : 8 Nos. Interconnection: 2mm Test points: 50 (Gold Plated) ; Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated Power supply: 220V \pm 10 % ,50 Hz Accessories Included :Line Cord, Manuals, Set of patch Cord , E manual Cabinet Housing : Enclosed on a plastic Molded box Software: Single user License , Teaching & Simulation Software for Analog communication with simultaneous display of waveform in time & frequency domain. with full theory & diagrams Hardware Lock should be provided with it. Noise generator : White Noise ; Additive White Gaussian Noise ;Periodic Random Noise Internal Signal Generator : Direct Digital Synthesizer Types of Signal : Sine, Square, Triangle, Arbitrary signals. Frequency : 1.2KHz, 2.4KHz, 4.8KHz, 9.6KHz SMD LED Indicators : 13nos for DDS Signal selection ; DDS Signal frequency selection ; Noise selection Selection Mode : Push switches Crystal Frequency : 8MHz Test Points : 5 nos (Gold plated) Gain selection for Modulating Signal : 10K potentiometer Gain selection for Noise : 10K potentiometer Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated Power supply: 220V \pm 10 % ,50 Hz</p>	20		
04.	<p>Four Channel Analog TDM Modulation/Demodulation trainer</p> <p>On-board sine generator(synchronized) On board DSB/DSBSC modulators Crystal controlled carrier frequency generator Four Analog input time multiplexed channels Four Envelope detectors ; On board four 4th order low pass filters 8 Switched faults for fault simulation On-board generators : \$ nos; Adjustable amplitude sine wave generators of 250 Hz, 500 Hz, 1 KHz and 2 KHz Input channels : 4 nos. Multiplexing : Time division multiplexing ; Modulation : DSB / DSBSC modulation signal frequency : 8 KHz, 16 KHz Band used: 100KHz & 200KHz Frequency used for carrier Channel: wired - copper wire Test points : 29 (Gold plated) ; Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated Power Supply : 230V \pm 10 % , 50 Hz Cabinet Housing : Enclosed on a plastic box with a cover No components on the top of the Trainer only block diagram to be provided Software: Single user License , Teaching & Simulation Software for Analog communication with simultaneous display of waveform in time & frequency domain. with full theory & diagrams Hardware Lock should be provided with it.</p>	20		
05.	<p>Frequency Division Multiplexer/Demultiplexer</p> <p>Two variable modulating (sinusoidal) input channels with provision of voice inputs Two DSBSC modulators for frequency band translation of two test signals Two Carrier Generators , Two Sets of Audio input Amplifier One adder/transmission Amplifier Two Demodulators ; Two low pass filters for smooth output Carrier Generator : Sine wave 100 KHz & 200 KHz Two variable modulating Modulating Input Freq: Sinewave 1KHz-10kHz (variable) Audio Input Amplifier: Gain of 100 (approx.) Modulator/Demodulation: DSBSC Modulator/Demodulator Low Pass Filters :: Second order Butterworth Filters with a cut off freq of 10kHz. Audio Output Amplifier: Output Amplifier with a gain of 20. Channel Used for communication: Wired - copper wire Band used : 100KHz & 200KHz Frequency used for carrier</p>	20		

	<p>Test points: 30 (Gold Plated) ;</p> <p>Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated</p> <p>Power supply: : 110-220 V AC $\pm 10\%$, 50Hz or 230V $\pm 10\%$ /50 Hz</p> <p>Accessories Included : Microphones, Headphones, Line Cord, Set of patch Cord , E manual</p> <p>Cabinet Housing : Enclosed on a plastic box with a cover</p> <p>No components on the top of the Trainer only block diagram to be provided</p> <p>Software: Single user License , Teaching & Simulation Software for Analog communication with simultaneous display of waveform in time & frequency domain. with full theory & diagrams Hardware Lock should be provided with it.</p>			
06.	<p><u>Freq. Modulation Using Armstrong Method</u></p> <p>Audio Oscillator (Message Signal) :</p> <p>Function :Sine ; Output:0-10 VPP ; Frequency :200Hz - 10 KHz</p> <p>Carrier Output : Function :Sine & Cosine ;Output :0-10 VPP</p> <p>Frequency :2KHz- 100 KHz</p> <p>FM Modulator :Armstrong Frequency Modulator</p> <p>FM Demodulator: Phase Locked Loop Detector (PLL)</p> <p>Low Pass Filter :10 KHz cut off frequency.</p> <p>Output Amplifier:1 No. with adjustable Gain</p> <p>Test Points:7 Nos. Gold Plated ;</p> <p>Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated</p> <p>Power Supply :230 V $\pm 10\%$, 50Hz</p> <p>Accessories Included :Line Cord, Manuals, Set of patch Cord , E manual</p> <p>Cabinet Housing : Enclosed on a plastic Molded box</p>	20		
07.	<p><u>PAM-PPM-PWM Modulation and Demodulation Trainer</u></p> <p><u>Pulse Modulation & Demodulation Techniques :</u></p> <p>1) Pulse Amplitude Modulation & demodulation 2) Pulse Width Modulation & Demodulation</p> <p>3) Pulse Position Modulation & demodulation.</p> <p>On-board sampling frequencies (Pulse) : 8kHz, 16kHz, 32kHz, 64kHz</p> <p><u>On-board Generator :</u></p> <p>1. Sine wave : 1kHz & 2kHz (Gain adjustable)</p> <p>2. Square wave : 1 kHz & 2kHz</p> <p>Low Pass Filter : 4th order BW Filter</p> <p>Voice Com : Voice Link using dynamic mic & speaker</p> <p>AC Amplifier : With adjustable Gain control</p> <p>Switched faults : 8 nos more</p> <p>Test Points:29 Nos. Gold Plated ;</p> <p>Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated</p> <p>Mains Supply : : 110-220 V AC $\pm 10\%$, 50Hz</p> <p>Accessories Included :E Manual, Microphone, Headphone.</p> <p>Cabinet Housing : Enclosed on a plastic box with a cover</p> <p>No components on the top of the Trainer only block diagram to be provided Cabinet Housing : Enclosed on a plastic Molded box</p> <p>Software: Single user License , Teaching & Simulation Software for Analog communication with simultaneous display of waveform in time & frequency domain. with full theory & diagrams Hardware Lock should be provided with it.</p>	20		
8	<p><u>Sampling & reconstruction Trainer</u></p> <p>Crystal Frequency : 8 MHz</p> <p>Sampling Frequency : 20, 50, 80,100, 200 & 400 KHz (switch selectable)</p> <p>Provision for input from a external signal generator for other sampling frequencies.</p> <p>On-board Generator : Synchronized 1 KHz sine wave (5 V) pp</p> <p>Duty cycle : 0 - 90% in Decade steps (Switch Selectable)</p> <p>Low -Pass Filters : Butterworth 2nd & 4th order ; Cut-off frequency : - 3.4 KHz each</p> <p>Test points: 50 or more (Gold Plated) ;</p> <p>Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated</p> <p>Power Supply : 110-220 V AC $\pm 10\%$, 50Hz</p> <p>Interconnection: 2 mm sockets ; Sufficient Nos of stackable patch cords</p> <p>Cabinet Housing : Enclosed on a plastic box with a cover</p> <p>No components on the top of the Trainer only block diagram to be provided</p> <p>Software: Single user License , Teaching & Simulation Software for Analog communication with simultaneous display of waveform in time & frequency domain. with full theory & diagrams Hardware Lock should be provided with it.</p> <p>External Signal Generator : Freq. range : 0.1 Hz - 1 MHz in 7 decade steps, variable control between steps ; waveform: Sine , square , Triangle & TTL ; Amplitude : 30Vpp Open circuit ; display</p> <p>Microcontroller controlled LCD for Frequency & Amplitude , External frequency counter up to 50 MHz ; Impedance : 50 Ω/ 600 Ω switchable ; Attenuation : 2 steps : -20 dB \pm 0.2 dB each ; Variable attenuation : 0 to -20 dB total of -60 dB.</p>	20		
9	<p><u>MSK Mod./Demodulation Trainer</u></p> <p>On board Data Generator ;On board Carrier Generator ;On board clock generators</p> <p>MSK Modulator ;MSK Demodulator</p>	20		

	<p>Data Source Data rate : 8 Kbps ;World Length : 8 bits ; Data Format : NRZ (Non Return to Zero) Clock Source : 8 KHz, 4 KHz Carrier Generators : 25 KHz (Sinusoidal) Pulse Shaping Waveform : 4 KHz. (Multiplier circuit with 4KHz carrier and 8 Kbps data speed) Facility to observe Phase regulation between carriers & at Final modulation output Test points: 35 or more (Gold Plated) ; Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated Power supply : 110-220V AC± 10%, 50 Hz Cabinet Housing : Enclosed on a plastic box with a cover No components on the top of the Trainer only block diagram to be provided Should be supplied with : 70 MHz Digital Storage Oscilloscope Sampling rate : 1 Giga Samples/s ; Memory: 2 Mpts ; Display: 7" Colour TFT LCD USB host & Device interface, RS 232C ; Edge, Video, Slope & Alternate triggering , Split screen for delayed time base, FFT & Alternate triggering.</p>			
10	<p><u>TDM Pulse Amplitude Modulation/Demodulation Trainer</u> Crystal Frequency : 8 MHz ; Analog Input Channels : 4 Multiplexing : TDM; Modulation : PAM On Board Analog Signal : 500 Hz, 1 KHz, 2 KHz and 4 KHz (Sine wave synchronized to sampling pulse)Adjustable amplitude and separate variable DC level) Sampling Rate : Four sampling signals :4 KHz / 8 KHz / 10 KHz / 20 KHz per channel (switch selectable) Sampling Pulse : With duty cycle variable from 0-90% in decade steps. Clock Regeneration at Receiver : Using PLL ; Test points: 50 (Gold Plated) ; Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated Mains Supply : 110-220 V AC ±10%, 50Hz Accessories : e Manual, Set of patch cord, Power supply Cabinet Housing : Enclosed on a plastic box with a cover No components on the top of the Trainer only block diagram to be provided. Software : Single user License , Teaching & simulation software for digital communication. Theory Part on digital communication should also be covered in software. Software should be a licensed version & should be supplied with hardware lock.</p>	20		
11	<p><u>Data Formatting and Carrier Mod/Transmitter Trainer</u> On-board Unipolar to Bipolar conversion.& data inverter. On-board 8-bit Data Source & Clock Source Data formats : NRZ (L), NRZ (M), RZ, AMI, RB, Biphasе(Manchester), Biphasе (Mark). Carrier modulation : ASK, FSK, PSK, DPSK, QPSK On-board carrier : Sine waves synchronized to transmitted data at 1.6 MHz, 960 KHz, (0 deg. phase) 960 KHz, (90 deg. phase) Test Points : 43 or more ; Interconnection: 2 mm ; Sufficient Nos of stackable patch cords Mains Supply : : 110-220 V AC ±10%, 50Hz Accessories : e Manual, Set of patch cord, Power supply. Cabinet Housing : Enclosed on a plastic box with a cover No components on the top of the Trainer only block diagram to be provided Software : Should be supplied with teaching & simulation software for digital communication. Theory Part on digital communication should also be covered in software. Software should be a licensed version & should be supplied with hardware lock. No components on the top of the Trainer only block diagram to be provided</p>	20		
12	<p><u>Data Reformatting and Carrier Demodulation Receiver Trainer</u> On - Board Biphasе Clock recovery , data squaring & Differential decoder circuit.On - Board 4th Order Butterworth filters & 8 bit Data Receiver Input : From Data Formatting and Carrier Modulation/Transmitter Trainer Data formats: 7 different data reconditioning formats NRZ (M), NRZ(L) ,RZ, AMI, RB, Biphasе (Manchester), Biphasе (Mark). Carrier Demodulation : ASK - Rectifier Diode ,FSK PLL Detector PSK /DPSK- Square Loop Detector QPSK -Fourth Power Loop Detector Biphasе Clock Recovery : By PLL Test points: 35 (Gold Plated) ; Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated Mains Supply : : 110-220 V AC ±10%, 50Hz Accessories : e Manual, Set of patch cord, Power cord. Cabinet Housing : Enclosed on a plastic box with a cover No components on the top of the Trainer only block diagram to be provided Software : Should be supplied with Single user License , Teaching & simulation software for digital communication. Theory Part on digital communication should also be covered in software. Software should be a licensed version & should be supplied with hardware</p>	20		

	lock.		
13	<p><u>Delta, Adaptive Delta and Delta Sigma Mod./Demod Trainer</u> Crystal Frequency: 6.400 MHz Sampling Clock Frequency: 50, 100, 200 & 400 KHz (Switch selectable) On board Generator: Synchronized & Adjustable Amplitude Sine Wave Generator of 1 KHz, 2 KHz, 3 KHz, 4 KHz Separate Variable DC level Integrator : Four integrator gain settings Normal, X 2, X 4, X 8 Low Pass Filter : Four th order Butterworth (Cut Off Frequency 4.8 KHz) Test points: 45 (Gold Plated) ; Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated Mains Supply : : 110-220 V AC $\pm 10\%$, 50Hz Interconnections : 2 mm socket Accessories : e Manual, Set of patch cord, Power cord. Mains Supply : : 110-220 V AC $\pm 10\%$, 50Hz Cabinet Housing : Enclosed on a plastic box with a cover No components on the top of the Trainer only block diagram to be provided Software : Should be supplied with Single user License , Teaching & simulation software for digital communication. Theory Part on digital communication should also be covered in software. Software should be a licensed version & should be supplied with hardware lock.</p>	<u>20</u>	
14	<p><u>16 QAM Trainer .</u> VLSI Based On board Digitally Synthesized Sine and Cosine wave Generator with Variable Step Frequencies On board Clock Generator with Step Variable Frequencies (150Hz, 300Hz, 600Hz, 1.2 KHz, 2.4 KHz, 4.8 KHz and 9.6 KHz and 19.2 KHz) On board Data generator with Step Variable data length (8, 16, 32, 64bits) Encoding Technique (4 bits encoding with Symbol Mapper, Gray to Binary Encoder) Modulation Technique (16QAM Modulation with I & Q Channel) Numerical Control Oscillator (on board NCO for demodulator) Decoding Techniques (4 bits decoding with Symbol Demapper, Binary to Gray Decoder) Receiver Type: Matched Filter type Power Supply: 110-220V AC$\pm 10\%$, 50 Hz; Test Points : 25 Cabinet Housing : Enclosed on a plastic box with a cover No components on the top of the Trainer only block diagram to be provided Should be supplied with : 70 MHz Digital Storage Oscilloscope Sampling rate : 1 Giga Samples/s ; Memory: 2 Mpts ; Display: 7" Colour TFT LCD USB host & Device interface, RS 232 ; Edge, Video, Slope & Alternate triggering , Split screen for delayed time base, FFT & Alternate triggering.</p>	<u>20</u>	
15	<p><u>Advanced Digital Communication Training System (Baseband)</u> Digital Synthesized Sine & Cosine wave generation with variable step frequencies : 3.1 KHz,1.6 KHz Clock generator with variable step frequencies : 3.1 KHz,1.6KHz Data generator : 256 Bit Pattern Encoding Techniques : 1bit, 2bit, 3bit, 4bit Modulation Techniques : ASK, FSK, BPSK, DBPSK, QPSK,DQPSK, $\pi/4$QPSK, OQPSK, M -ary ASK, M -ary FSK, MSK, 8-PSK, 8-QAM, 16-PSK, 16-QAM, For Value of M = 4 Decoding Techniques : 1bit, 2bit, 3bit, 4bit De-Modulation Techniques : ASK, FSK, BPSK, DBPSK, QPSK,DQPSK, $\pi/4$QPSK, OQPSK, M -ary ASK, M-ary FSK, MSK, 8-PSK, 8-QAM, 16-PSK, 16-QAM, Value of M = 4 Baud Rate for PC to PC interface is 4800baud. Channel: Copper wired Large 5.7" Touch Panel TFT LCD for display of complete system control, data capture & analysis., TFT (64K, Color LCD), 320 x 240 In build Mixed Signal Oscilloscope-MSO (DSO + 8 Channel Logic Analyzer) Number of Channels : 2 Analog Channel (CH1, CH2) + 8 Channel Logic Analyzer (DO –D7) Real-time Sampling : 50MSPS Memory Depth : 8K Per Channel Trigger Sources : CH1, CH2 Time Base Range : 1ms to 1μs , Vertical Resolution : 8bit Math : Addition, Subtraction, Multiplication Waveform Interpolation: Linear Display: TFT (64K, Color LCD), 320 x 240 Power supply : 110-220V AC$\pm 10\%$, 50 Hz Cabinet Housing : Enclosed on a plastic box with a cover No components on the top of the Trainer only block diagram to be provided.</p>	<u>20</u>	

16	<p><u>Error Detection and Correction-Cyclic Code Trainer</u> On-board Data and Code clock generation ,On-board data generator BCD rotary switches for Data Selection; LED Numeric display Multiple data rate and code rate selection ;Seven bit code for four bit running or static data Technical Specifications Crystal Frequency: 4.096 MHz ; Data Rates: 16 KHz, 8 KHz, 4 KHz, 2 KHz and 1 KHz Code Rates: 32 KHz, 16 KHz, 8 KHz, 4 KHz and 2 KHz Word Length: 4 bits ; Code Length: 7 bits code and 1 stuffed bit Data Format: NRZ (Not Return to Zero) Test points: 45 (Gold Plated) ; Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated Power supply : 110-220V AC± 10%, 50 Hz Cabinet Housing : Enclosed on a plastic box with a cover No components on the top of the Trainer only block diagram to be provided. Convolution encoder & Decoder Convolution encoder Selectable rate: N=3, rates ½ ; N = 7, rate ¾. Manual and Continuous mode operation Encoder Code tree On-board data and clock generation & error generation Convolutional decoder Selectable rate: N=3, rates ½; N = 7, rate ¾. State and trellis diagram Support Hard decision and soft decision decoding Decoded data bit display; Single supply Word length: 4 bits ; Selectable rate : 1/2 & 3/4 Dat format: NRZ Sufficient Nos of stackable patch cords gold plated Power supply : 110-220V AC± 10%, 50 Hz</p>	<u>20</u>		
17	<p><u>PCM, DPCM, CVSD Modulator & Demodulator</u> Modulator and Demodulator on same board On-board DDS Signal Generator for standard and Arbitrary signals Selectable sampling frequencies with respective line speed On board Transmission effect; On board 2nd order Butterworth Low Pass filter ; SMD LED indicators Modulation & Demodulation Techniques : PCM ; DPCM & CVSD Internal Signal Generator : Direct Digital Synthesizer Types of Signal : Sine, Square, Triangle, Arbitrary signals Frequency : 500Hz, 1KHz, 2KHz, 3KHz External Signal : Types of Signal : Sine, Square, Triangle, Arbitrary signals Maximum Input Voltage : 3Vpp (Max.) +1.5V DC offset ; Frequency : 500Hz to 3.5KHz SMD LED Indicators : 44 nos for DDS signal selection DDS signal frequency selection ;Sampling selection , Technique selection & Interconnect path Transmission Effect : Attenuation (7dB & 10dB) ; Noise & Filter Encoding : 8 Bit Quantizer Type : Linear Number of Test Points : 38 nos.(Gold plated) Crystal Frequency : 8MHz Sampling Frequencies : 4KHz, 8KHz, 16KHz, 32KHz Line Speed : 32KHz, 64KHz, 128KHz, 256KHz Selection Mode : Push switches Low Pass Filter : Cut-off frequency-5KHz Power Supply : 110V - 260V AC, 50 Hz</p>	<u>20</u>		
18	<p><u>4-Channel TDM-PCM Transmitter & Receiver</u> Modulator and Demodulator on same board On-board DDS Signal Generator for standard and Arbitrary signals Selectable sampling frequencies with respective line speed On board Transmission effect; On board 2nd order Butterworth Low Pass filter ; SMD LED indicators Modulation & Demodulation Techniques : Two channel TDM-PCM & Four channel TDM-PCM Internal Signal Generator : Four dedicated Direct Digital Synthesizer Generators for each channel Types of Signal : Sine, Triangle, Arbitrary signal Frequency : 500Hz, 1KHz, 1.5KHz, 2KHz, 3KHz SMD LED Indicators : 54 nos for DDS signal selection ;DDS signal frequency selection ,Sampling selection ;Technique selection ;Interconnect path</p>	<u>20</u>		

	<p>Crystal Frequency : 8MHz ; Sampling Frequencies : 8KHz, 16KHz, 32KHz TDM techniques based on : Bell lab system Selection Mode : Push switches Number of Test Points : 40 nos (Gold plated). Low Pass Filter : 4nos. Cut-off frequency-5KHz Power Supply : 110V - 260V AC, 50Hz</p>			
19	<p><u>Digital Companding A-Law & μ Law</u> Compression and Decompression of data on same board On-board DDS Signal Generator Compression and Decompression Techniques : A-Law & μ-Law Signal Generator : Generated Sine wave 14 Bit data input through Dip switch. SMD LED Indicators : 73nos, for Dip based input data Compressed output ,Decompressed output & Technique selection Crystal Frequency : 8MHz ; Direct Digital Synthesizer Values of A & μ : A = 87.6 and 8 bit μ 255 Test Points : 37nos (Gold plated). ;Power Supply : 110V - 260V AC, 50Hz Included accessories : 2mm Patch cord - 2nos & FRC Cable 16 pins -1no.& Power supply.</p>	<u>20</u>		
20	<p><u>Basic CDMA DSSS Trainer</u> Direct Sequence Spread Spectrum (DSSS) generator and decoder Analog Modulators : Binary Phase Shift Keying (BPSK)Modulator & Pulse Width Modulator Analog Demodulators :Binary Phase Shift Keying (BPSK) Demodulator & Pulse Width Demodulator Data Source : Data rate : 30 Kbps ;Word length : 8 bit Data format : NRZ (Non Return to Zero) ; Clock frequency : 30 KHz PN Sequence Generator ;Data rate : 240 Kbps ;Word length : 15 bit Data format : NRZ (Non Return to Zero) ; Clock frequency : 240 KHz Audio Signal Generator : 3.4 KHz (variable amplitude & Frequency) Carrier Generators : 1.44 MHz (Sinusoidal) DSSS Generator : By EX-ORing PN Code & Data Modulators & Demodulator : PWM & BPSK Test points : 40 (Gold plated) ; Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated Mains Power Supply : 230V\pm 10%, 50Hz Included Accessories : 2mm Patch cord 16" : 20 nos.;Mains cord : 1 no. Trainer should be encased in a plastic box with a cover to protect it from dust .There should be no components on the top only block diagram should be provided on top of trainer.</p>	<u>20</u>		
21	<p><u>Two Channel CDMA (DSSS and FHSS) Trainer</u> Data rate : 16Kbps, 8 Kbps, 4Kbps ;World Length : 8 bits ; Data Format : NRZ (Non Return to Zero) PN Sequence Generators Chip Clock : 240 KHz, 120 KHz, 60 KHz, 16KHz, 8KHz, 4KHz. Sequence type : Maximal length sequence Sequence patterns : Selectable through feedback taps in LFSR. BFSK frequencies : 100 KHz for mark and 50 KHz for space Frequency synthesizer O/P : Sinusoidal Frequency synthesizer frequencies : 1.6 MHz, 1.4MHz, 800KHz, 400KHz. Hopping channels : Four No. of hops per data period : variable (selectable for slow and fast hopping) Interconnections : 2mm socket Power Supply : \pm 5V, \pm 12V DC, 200mA Test points : 36 (Gold plated) ; Interconnection: 2 mm sockets & Sufficient Nos of stackable patch cords gold plated . Mains supply: 230V Ac/50Hz</p>	<u>20</u>		
22	<p><u>Wireless LAN Trainer with 4 wireless Nodes</u> PC to PC communication with IEEE 802.3 Peer to Peer network ,Client - Server network Design of Star topology using 100Base-Tx Design of Bus topology using 10Base-2 Design of Ring topology using DB9 Simulation of Distance Vectors and Link State Algorithms Socket Programming exercise for LINUX Encryption/Decryption Technique Type of Encryption & Decryption : WEP 64/128 bit Wireless access point should be Provided Facility to send any file over LAN. Detailed introduction to TCP/IP Model (4 Layer Model) Video Tutorials for software operation Creation of cables for network connections Network design using RJ45 & DB9 connectors</p>	<u>2</u>		

	<p>Socket programming and processing Wireless LAN with 803.11b/g Various LAN Protocols Data rate up to 100Mbps Antenna power in dB watt used for wireless : 5dBi high gain ; Type : Strip line Monopole Data transmission Speed in wireless : 150 Mbps max Variable packet size & Variable packet delay Error generation (Manual and Auto) Color coded real time graphical representation of entire transmission & reception Graphical Analysis of LAN performance with various parameters and protocols Save / Print option for graphs ,User friendly software Switch faults in both hardware & software Exhaustive course material & references Hardware : PC to PC using RJ-45 Connector , Star topology using RJ45 Connector , Bus topology by using end terminator Ring topology using DB9 Connector Data transmission speed: 10/100 Mbps 4 wireless Nodes Software: Star, Bus & Ring selection Protocols: CSMA/CD, CSMA/CA, Stop N Wait, Go back to N, Selective repeat, Sliding Window, Token Bus, Token Ring Packet size: 128, 256, 512, 1024, 2048, 4096, 8192, 16384 Inter Packet delay: 1000 – 5000 ms Error generation: Acknowledgment lost, bad packet, auto error generation Graphical Representation: Real time Graphic representation of data on s/w screen with packet details Network details: Indication of computer name, IP address, MAC address, Port number, status of network. Network & protocol analysis: Indication of packet serial number, file name, file size, file number, receiver name, receiver IP address , total packets, packet length, time out, protocol, topology, receiver, MAC address, port number, file send start time, file sent completion time, transmission time data rate(Mbps),percentage error. Detection of collision on live network Trainer should have no components on the top of the board & should be encased in a plastic moulded case with cover on the top.</p>			
23	<p>GSM Trainer with Application Module (understanding AT commands) GSM capability : GSM 900 / 1800/850/1900 E - GSM GSM data services : Asynchronous, Transparent & Non Transparent modes. 14.4 kbits / s SIM Interface : 3 V RF characteristics : Receiver EGSM Sensitivity : < -104 dBm ; DCS Sensitivity : < -102 dBm Selectivity @ 200 KHz :>+9 dBc ;Selectivity@ 400 KHz :>+41 dBc Dynamic range : 63 dB ; Intermodulation : >-43 dBm C-channel rejection : ³ 9 dBc Transmitter Maximum output power (EGSM): 33 dBm ± 2 dB Maximum output power(DCS) : 30 dBm ± 2 dB Minimum output power(EGSM) : 5 dBm ± 5 dB Minimum output power (DCS 1800): 0 dBm ± 5 dB Noise in 925 - 935 MHz : < -67 dBm Noise in 935 - 960 MHz : < -79 dBm Noise in 1805 - 1880 MHz : < -71 dBm Phase error at peak power : < 5° RMS Frequency error : ± 0,1ppm max. Current consumption : Max 500 mA Power Supply : 110V - 260 V AC, ±10%, 50Hz Included Accessories : Serial Cable with Hands Free Kit : 1 no. Antenna with Coaxial Cable 30 cm : 1 no. Application Module : It should help in understanding working fundamentals of GSM by camping to the real service provider network. It also demonstrates the application controlling appliances through SMS using AT commands. Accessories : Serial to Parallel Cable : 1 no. ;Bulb 230VAC to 110VAC : 1 no. Patch cord (2mm) : 1 no.</p>	<u>2</u>		
24	<p>Advanced Fiber Optic Trainer-Dual Channel & PC-PC Communication Facility & Bit error rate & Eye Pattern measurement Transmitter :: 2 Nos. Fiber Optics LED having peak wavelength of 660nm & 950nm</p>	<u>20</u>		

	<p>Receiver : 2 Nos. Fiber optics Photo detector : Wavelength 660 & 950 nm Modulation Technique : AM, FM & PWM Drivers : 1 No. with Analog & Digital Modes PLL Detector : 1 No. Comparator : 2 Nos. Filters : 2 Nos., 4th Order Butterworth, 3.4 KHz cutoff Frequency Analog Bandwidth : 350KHz ;Digital Bandwidth : 2.5MHz Function Generators : 1) 1KHz Sine Wave (Amplitude Adjustable) 2) 1KHz Square wave (TTL) Voice Link : F. O. Voice Link using microphone & speaker (Built in) PC –PC Communication : Using 2 Channel through RS 232 Port : RS232 Switched faults: 4 in Transmitter and 4 in Receiver Fiber Optics Cable : Step Indexed Multimode PMMA Plastic Cable Connector Type : Standard SMA Core Refractive Index : 1.492 ; Clad Refractive Index : 1.406 Numerical Aperture : More Than 0.5` Acceptance Angle : More Than 60 deg. Fiber Diameter : 100/1000 Microns ; Outer Diameter : 2.2mm : Fiber Length : 0.5 m & 1 m Test Point : 50 or more Accessories Included : Line Cord, Manuals, NA measurement Jig, Mandrel, Fiber Cables, Microphone, Headphone, Patch cords Module to support measurement of Bit Error rate & Eye Pattern. Data Generator with selectable clock (64/ 128/ 256 KHz) Noise Generator with variable gain Eye pattern observation and Bit Error Rate measurement Four digits Bit Error Counter (LED Seven segment display) Trainer should be encased in a box with cover ,with no components on the top only block diagram should be provided on top of trainer .</p>			
25	<p>Setup to study Mode Characteristics in Fiber optics Laser source of 660nm ;Single mode and Multimode fiber cables with FC connectors Precision XYZ positioner for coupling Laser light into optical fiber Opaque screen ; Fiber holder assembly ; Customized mechanical fixtures required to perform experiments ; NA calculation software Specifications Light Source : Laser Diode ; Wavelength : 660 nm Output Power : 2 mW Coupling Efficiency : >70% for SM fiber ; >90% for MM fiber Fiber Optic Cable : Single Mode & Multimode Connector type : FC Power Supply : 220V, 50Hz Accessories: Precision XYZ positioner 1 No., Fiber Cable coupler 1 No. Lens Assembly 1 No., Single mode fiber cables 1 No., Multimode fiber cables 1 No. , NA Scale with holder 1 No ;Mains Cord 1 No.</p>	<u>2</u>		
26	<p>Klystron Based Bench X Band</p> <p>Solid State Klystron : 1 Power Supply digital Klystron Mount with : 1 Klystron tube 2K25/2K27 : 1 Isolator : 1 Frequency Meter with 1.5 " : 1 Colour TFT LCD 128 X 128 Res. Variable Attenuator : 1 Slotted Section : 1 Tunable Probe : 1 Detector Mount : 1 Movable Short : 1 Fixed Short : 1 Matched Termination : 1 Digital VSWR Meter with : 1 Back lit LCD display & bar graph Wave Guide Stand : 4 S.S. Tuner : 1 Magic tee : 1 MHD Coupler 10 dB : 1 Y Circulator : 1 Fixed Attenuator 10 dB : 1 Cross Directional coupler : 1 Accessories: Cooling Fan : 1</p>	<u>6</u>		

	<p>BNC cable : 2 Microphone : 1 Experiment Manual : 1 Wall chart on Microwave : 1 Video Demo CD : 1</p> <p>Simulation & Teaching software based on Microwave 01 user With Hardware lock. 70 MHz Digital Storage Oscilloscope 1nos Sampling rate : 1 GS/s ; Memory: 2 Mpts ; Display: 7" Colour TFT LCD USB host & Device interface, RS 232 ; Edge,Video, Slope & Alternate triggering ;Split screen for delayed time base, FFT & Alternate triggering. VSWR Meter should Have built in Socket for headphone For audio comm. KPS Should support audio communication over Microwave Bench.</p> <p><u>Klystron power supply</u> Should support audio communication over Microwave bench. Beam supply: Voltage 240-420 VDC variable ; Current: 50 mA Regulation : 0.5 % for 10 % I/P variation. ; Ripple: < 5 mV rms on load. Repeller supply : - 18V to -270 V DC Variable on load. Regulation : 0.25 for 10 % input variation. Filament supply : 6.3 VDC (adjustable on rear panel) Overload Trip : 65 mA. ;Modulation: AM(square)FM (sawtooth) Frequency range : 500-2000 Hz ,50-150 Hz ; Amplitude : 0-110 Vpp ,0-60 Vpp. External : Through external modulating signal Display: Digital display for :Beam voltage 2) Beam current 3) Repeller voltage. Modulation selector : CW/AM/FM/EXT. 3 ½ Digit panel meter : 2V Meter selector : Beam voltage/current/repeller. Connector : a) 8-pin octal socket b) BNC for external Mod. Power Supply : 220 V AC ±10%,50 Hz. ; Audio Input : Mic Jack for audio communication.</p> <p><u>VSWR Meter</u> Display : 1.5" Color TFT LCD with resolution 128×128 to display scale for dB, SWR (Low, Medium and High) with BAR Graph scale Sensitivity : 0.1 μV for 200 ohms input impedance Noise Level : Less than 0.02 μV Range : 0 - 60 dB in 10 dB steps ; Input : Un-biased low and high impedance biased crystal (200 ohms and 200 K ohms) Display Select : SWR 1 - 9 ; dB 0 - 10 with bargraph Modes : Normal ; Audio ; PC-Interface Gain Control : Adjusts the reference level, variable range 0 -10 dB(approx) Input Connector : BNC (F) Input Frequency : 1000 Hz ± 10% Power Supply : 220 V ± 10%, 50Hz</p> <p><u>Frequency Meter :</u> Display :1.5" Color TFT LCD with resolution 128×128 Frequency (GHz) : 8.2-12.4 ; Calibration Accuracy : ± 2% Calibration Increment : 5 MHz ; Max. VSWR :1.28 At 10.5GHz Return Loss : 18.2 At 10.5GHz</p>			
27	<p><u>Microwave Integrated Circuits Trainer</u> The Setup should Consist of : 1) Microwave Signal generator 2) VSWR Meter 3) MIC Components 4) Digital Storage Oscilloscope 5) Required Accessories</p> <p>Microwave Signal generator Frequency Range : 2.2 - 3GHz continuously variable Display : 16 x 2 LCD ;Display Accuracy : 40MHz Impedance : 50V ; Min RF level : 5mW ; Output Level Variation : 10 - 20 dB Operating Modes : Sweep, CW, Int. AM, Int. FM, Ext. AM, PC comm. Modulating Freq. : 100Hz to 5kHz AM square wave, FM triangular wave Power Supply : 230V ±10%, 50Hz</p> <p>VSWR Meter Sensitivity : 0.1μV for 200W input impedance for full scale deflection Noise Level : Less than 0.02μV ; Range : 0 - 60 dB in 10 dB steps Input : Un-biased low and high impedance ; crystal biased crystal (200 & 200K) Meter Scale : SWR 1-4, SWR 3-10, dB 0-10, expand SWR 1-1.3, dB 0-2 Gain Control : Adjusts the reference level, variable range 0 -10 dB (approx) Input Connector : BNC (F) ; Input Frequency : 1000Hz ±10% Power Supply : 230V ±10%, 50Hz ;Power consumption : 2VA (approx) Digital Storage Oscilloscope Bandwidth : 70 MHz ; Real time Sampling rate : 1 GS/s ; Memory: 2 Mpts ; Display: 7" Colour TFT LCD ;USB host & Device interface, RS 232 ; Edge,Video, Slope & Alternate triggering ;Split screen for delayed time base, FFT & Alternate triggering.</p>	<u>01</u>		

	<p>MIC Components :</p> <p>Branch line Directional Coupler: Material: Ceramic substrate ; Dielectric constant : 3.02;Coupling: 3dB</p> <p>Low Pass Filter: Cut off freq: 2.5 GHz approx ; Material: Ceramic substrate ; Dielectric constant : 3.02</p> <p>Band Pass Filter : Center freq: 2.5 GHz approx ; Material: Ceramic substrate ; Dielectric constant : 3.02</p> <p>Ring Resonator : Resonance frequency: 2.4 GHz ; Material: Ceramic substrate ; Dielectric constant : 3.02</p> <p>Rat-Race Hybrid Ring Coupler : Material: Ceramic substrate ; Dielectric constant : 3.02;Coupling: 3dB</p> <p>MIC Patch Antennas (2 Nos.) :Freq: 2.5 GHz ; Material: Ceramic substrate ; Dielectric constant : 3.02</p> <p>Yagi antenna ,Dipole Antenna : : Freq: 2.4 GHz to 3 Ghz ; ; Material: FR-4 Grade Epoxy Glass;</p> <p>Dielectric constant : 4.7</p> <p>MIC Amplifier : Connectors : SMA Female ; Biasing Voltage : +12V DC ; Gain : 10dB or more Operating frequency : 150MHz to 3GHz ;</p> <p>RF Switch : Frequency Range : DC to 5GHz ; Rise/fall time : 6 ns typical; Type : SPDT,</p> <p>RF Mixer : Frequency Range : 2.0 to 7.0GHz ; Conversion Loss : 6.2dB typical ; RF Power : 50mW;</p> <p>L-R Isolation : 30 dB typical ;</p> <p>Local Oscillator ; Frequency Range : 2.2 to 3GHz ; Tuning Voltage : 5V DC ;Operating Voltage : 5V DC</p> <p>Measuring Line : Dielectric Material : Ceramic Substrate ; Dielectric Constant : 3.02</p> <p>Isolator : Isolation : 15dB ; Impedance : 50 Ohms ;Insertion loss : 0.8dB Max ;Avg Power : 5W ;</p> <p>Design Tolerance : ±5%</p> <p>Circulator : Isolation : 15dB ; Impedance : 50 Ohms ; Insertion loss : 0.8dB Max ;Avg Power : 5W</p> <p>Port : 3 ;Design Tolerance : ±5%</p> <p>Accessories to be supplied : Matched Loads (5 Nos.) ;Short Coaxial Detector ;I</p> <p>Microstrip Directional Coupler (10 dB) ;SMA to SMA Adapters (Both male & female) ; SMA (male) connector fitted cables ; Attenuator (3 dB);I +12V DC Adaptor ; Transmitting & Receiving Mast ; SMA (Male) to BNC (Female) adaptor ; 3-pin Lunar cable.</p>			
28	<p>Radar Trainer</p> <p>Transmitter Frequency :10 GHz (approx)</p> <p>Type: Doppler; CW</p> <p>Transmitter Power : 10 -15 mW</p> <p>Operating Voltage : 8.6 V</p> <p>Antenna : Horn type</p> <p>IF output : Audio range</p> <p>Power supply : 230VAC +/- 10%, 50Hz</p> <p>Alarm : on board detected signal.</p> <p>Software : oscilloscope in real time & storage mode with FFT with variable time base & volt/div & cursors.</p> <p>Display : peak to peak voltage</p> <p>Time domain : Doppler freq. in time domain.</p> <p>Freq. domain : Doppler freq. in frequency domain</p> <p>Control Panel : Measurement of Doppler frequency, amplitude, velocity & RPM</p> <p>Contents :</p> <p>Trainer Board : 01</p> <p>Audio cable : 01</p> <p>Din connector cable : 01</p> <p>Mains cord : 01</p> <p>Tripod stand : 01</p> <p>Fan stand : 01</p> <p>Sliding Platform : 01</p> <p>Different objects : 01</p> <p>Horn Antenna : 01</p> <p>Trans receiver : 01</p> <p>Software CD : 01</p> <p>Pendulum with stand : 01</p> <p>Tuning fork : 01</p> <p>Text Exp. Manual : 01</p> <p>Multimedia smart Manual : 01</p> <p>Digital Storage Oscilloscope</p> <p>Bandwidth : 70 MHz ; Real time Sampling rate : 1 GS/s ; Memory: 2 Mpts ; Display: 7"</p> <p>Colour TFT LCD ;USB host & Device interface, RS 232 ; Edge,Video, Slope & Alternate triggering ;Split screen for delayed time base, FFT & Alternate triggering.</p>	<u>1</u>		
29	<p>Antenna Radiation Pattern & other parameters study training sytem with Micro strip &</p>	<u>1</u>		

	<p><u>Rod Antenna (22 different type) Antennas & Antenna Design & Modeling software</u></p> <p>RF Generator : 750 MHz approx. (output adjustable) Tone Generator : 1 KHz approx. (output adjustable) Directional Coupler Forward & Reverse (selectable) Matching Stub : Slider type Antenna Rotation : 0-360 deg. Resolution 1 deg. Receiving Antenna : Folded dipole with reflector Detector Display : Level adjustable meter with LCD display Power Supply : 220 V \pm10 %, 50 Hz Interconnections : 2 mm Banana sockets</p> <p>Main Unit should be separately provided with LCD display for SWR Separate unit for Matching stub should be slider type Independent Units for Detector , Transmitter mast , & receiver Mast. 22 Antennas to be provided with the Trainer . 1. Transmitting Antennas (22) • Dipole $\lambda/2$ • Folded Dipole $\lambda/2$ • Dipole $\lambda/4$ • Yagi UDA Folded Dipole (3 E) • Yagi UDA Folded Dipole (5 E) • Yagi UDA Dipole (5 E) • Horizontal End Fed Hertz Antenna • Horizontal End Fed Zeppelin Antenna • Ground Plane with Reflector & Director • Slot Antenna $\lambda/2$ • Loop Antenna • Helix Antenna • $\lambda/2$ Phase Array • Combined Collinear Array • Log Periodic Antenna • Rhombus Antenna • Cut Paraboloid Reflector Antenna • 3 $\lambda/2$ Dipole Antenna • Circular Patch Antenna • Rectangular Patch Antenna • Triangular Patch Antenna • Semi Circular Patch Antenna 1 no.</p> <p>Accessories 1. Detector Antenna folded dipole 2. Current Probe ; 3. Mounting stands ; 4. BNC-Tee 5. BNC-BNC adapter M ; 6. BNC-BNC adapter F 7. BNC-BNC cable ; 8. Aligner ;9. Operating manual 10. Matching stub ;11. Radiation Pattern Plotting Software 12. Polar graph (2 types) ;13. Antenna fabrication kit 14. Power cord ; 15 VIP Carrying case for accessories .</p> <p>Antenna Design & modeling software Windows-compatible antenna analysis, modeling, and design software package. It should contains more than 40 separate routines treating wire antennas, aperture antennas, microstrip antennas, arrays, and transmission lines and waveguides. These routines should be integrated into a menu-driven, user-friendly system for quick evaluation of impedance and patterns for a wide variety of antenna types.</p> <p>Features • 3-D color pattern plots ;• Impedance matching with Smith chart • Analysis of circular planar arrays ;• V-dipole antenna analysis • Wire loop antenna analysis ;• Log periodic dipole array analysis • More general wire antenna geometries ;• Facility to copy graphs to Windows clipboard ;• Facility for error checking ;• Movable labels on pattern and Smith plots ;•Facility for plot resizing ;• Facility to save Color settings• Facility to view All wire geometries in 3-D ;• Plotting of E/H or E-theta/E-phi patterns ;• Antenna Short Course should be included on CD</p>			
30	<p><u>A.T. Exchange/EPABX Training System with DTMF Telephone Trainer .</u></p> <p>Functional Blocks should be displayed on board Provision to Study of various Detection Phenomena LED Visualizations should be provided Provision to Study of Switching Phenomena should be provided. Provision to study of Traffic Units Switched Faults should be provided Software CD containing Traffic Analysis Calculator & Working Presentation of EPABX should be provided. Specifications: Processor: Microcontroller P-89 Mode: Manual/Programmable Multiplexing: Time division Multiplexing Number of Inputs : 2 Trunk / Direct Lines Number of Extension : 4 Lines Technology : Cross Point Space Division (Microprocessor based) Standard Features : Tones such as Dial, Busy, Ring etc Dialling - DTMF and Pulse (Ratio 10pps) Program Memory : 64 kb EEPROM Loop Resistance : Extension -600 Ohms, Co-line- 1200 Ohms Cross Talk Attenuation : >70 dBm Power Supply : 230 V \pm 10%, 50 Hz Switched Faults : 8 in numbers</p>	<u>10</u>		

<p>Test Points : 37 nos (Gold plated)</p> <p>Features that can be set : Line Hunting, Direct Access to trunk line, Redial, Line Status Indication, Automatic call back, Do Not Disturb, Call Transfer, Call Pick Up, Direct Access Trunk Call Forwarding, Call parking, Conference, Hot line System, Extension Privacy, Call Transfer, Barge in</p> <p>Included Accessories : Patch Cords ,AC Adaptor : 1 no.</p> <p>Mains cords ,Telephone instruments : 4 nos. DTMF Telephone Trainer 1 No.</p> <p>DTMF Telephone Trainer</p> <p>Operation: Stand Alone with One DOT/EPABX Line connection Port</p> <p>Handset: Handset connection Port (RJ-45)</p> <p>Key Board:3X4 Matrix Key Board</p> <p>Dialer :DTMF (Tone) and pulse dialing radical up to 32 digits, ON/OFF Hook Switch</p> <p>Indication : Line On/Pulse Dialing Indication Tone, Dialing Indication</p> <p>Control :Ringer Volume Control</p> <p>Speech Path :Non Blocking</p> <p>Dial Pulse Ratio :66 to 33% Make Break Ratio (approx)</p> <p>Input Power: From Internal Power Supply/ From Telephone Line</p> <p>Test Points :At least 25 Test Points should be provided to observe various signals/voltage to Understand the working of Telephone</p> <p>Switch Faults :4 Nos.;Power Supply : 230 V 10%, 50/60Hz</p> <p>Accessories :Telephone Handset, Mains Cord & Patch cords .</p>			
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