



TENDER DOCUMENT

FOR

**PROCUREMENT OF LABORATORY
EQUIPMENT**

FOR

**STRENGTHENING OF VARIOUS LABS OF
ELECTRICAL ENGINEERING DEPARTMENT**

**MEHRAN UNIVERSITY OF
ENGINEERING AND TECHNOLOGY
SHAHEED Z.A BHUTTO CAMPUS KHAIRPUR,
MIR'S
SINDH- PAKISTAN**

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B.O.Q. OF THE LABORATORY EQUIPMENT FOR ELECTRICAL ENGINEERING DEPARTMENTS OF MUET, Z.A BHUTTO CAMPUS KHAIRPUR, MIR'S.
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01.	LABORATORIES OF ELECTRICAL ENGINEERING	PINK
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MEHRAN UNIVERSITY OF ENGINEERING & TECHNOLOGY,
SHAHEED Z.A BHUTTO CAMPUS KHAIRPUR MIR'S

Phone No.0243-9280314

No. PD/MUET/KHP/NIT/-351

Dated: 14-12-2015

NOTICE INVITING TENDER

Sealed tenders are invited from all the interested Suppliers, Manufacturers, Sole Distributors & Sole agents in the relevant category Pre-qualified with MUET, Jamshoro and Mehran University Engineering & Technology Shaheed Zulifiquar Ali Bhutto Campus Khairpur Mir's for supplying, installation, testing & commissioning and putting into operation and demonstration of Equipment required for the following work:

S#	Name of Work	Tender Fee	Completion Period	Earnest Money	Date of Purchase	Date of Submission of Bids
1	Procurement of Equipment for Strengthening of Various Labs of Electrical Engineering Department at MUET, Shaheed Z.A Bhutto Campus Khairpur Mir's	5,000.00	06 Month	2%	21-12-2015 To 05-01-2016	06-01-2016

The terms and conditions are given as under:-

The tender documents can be had from the Office of Project Director or can be downloaded from SPPRA website i.e. www.pprasinidh.gov.pk on the payment noted above (non-refundable) on any working day except the day of opening of tenders. The sealed tender on prescribed proforma along with 2% earnest money of total bid in the form of Pay Order in favour of the Project Director, should be deposited in the above office by 06-01-2016 upto 12.00 (Noon) and same shall be opened on the same day, @ 12.30 p.m. in same office, in presence of the Contractors / representative, who so ever will be present at that time. In case of any unforeseen situation resulting in closure of office on the date of opening or if Government declares Holiday the tender shall be submitted / opened on the next working day at the same time & venue Any conditional or un-accompanied of the earnest money, tender will not be considered in the competition.

The selection / evaluation criteria of the equipment shall be based on price-cum fulfillment of technical specification and functions specified.

The Procuring Agency reserves the right to reject any or all bids subject to relevant provisions of SPP Rules, 2010 and may cancel the bidding process at any time prior to the acceptance of a bid or proposal under Rule-25" of said Rules.

**Project Director,
Mehran University of Engg. & Tech.
Shaheed Z.A Bhutto Campus Khairpur Mir's.**

ARTICLES OF AGREEMENT

This Agreement made this _____ day of _____ 2015, by and between the Pro-Vice Chancellor, Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir's, including his successors in office and Assignees / Agents, acting through the Project Director, Mehran University of Engineering & Technology, hereinafter called the "**University**", of the one part,

And _____ of
(name and designation of the authorized person), located
at _____, hereinafter called the
"**Contractor**" which expression shall include their successors, legal representatives of the
second part.

Whereas the **University** requires laboratory equipment at Khairpur Mir's, and whereas the **Contractor** has agreed to supply, install, put into operation and demonstrate the working of the said Equipment valued at Rs. _____ (in figures and words) in the period of _____ months, subject to the terms and conditions set forth, hereinafter, which have been accepted by the **Contractor**.

(amount in figures and words)

Now this Agreement witnesses 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** hereinafter referred to.
2. The following documents which, for the purpose of identification, have been signed by _____ on behalf of the **Contractor**, and by
(name and designation of the authorized person)
_____ on behalf of the **University**, all of
(name and designation of the authorized person)
which shall be deemed to form and be read and construed as a part of this **Agreement** viz.:

- a) Articles of Agreement;
- b) Instructions to Tenderers;
- c) Conditions of Contract;
- d) Contractor's Offer including the relevant correspondence prior to signing of this Agreement with all Annexures duly filled in;
- e) The specifications of the equipment; and
- f) Bill of Quantity with prices.

- 3. In consideration of the payment to be made to the Contractor, the **Contractor** hereby **covenants** with the University to supply, deliver, install, put into operation and demonstrate the working of the Equipment in conformity in all respects of the Contract & the order form No. _____.

- 4. The **University** hereby **covenants to pay** the Contractor in consideration of the supply, delivery, installation, putting into operation and demonstration of the working of the Equipment the contact price in the manner prescribed by the Contract and approved by the University.

In Witness Thereof the parties have hereunto set their respective hands and seals, the day, month and year first above written.

WITNESSES:

University_____

Contractor_____

Witness No.1:

Witness No.1:

Signature:_____

Signature:_____

Name: _____

Name: _____

Designation: _____

Designation: _____

Witness No.2.

Witness No.2:

Signature:_____

Signature:_____

Name: _____

Name: _____

Designation: _____

Designation: _____

INSTRUCTIONS TO TENDERERS

The Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir's, Sindh, intends to purchase Laboratory Equipment under the approved schemes. The purchase will be financed through the cash provided by the Government of Sindh and Higher Education Commission Islamabad. This tender is issued for the supply, installation, putting into operation and demonstration of the working of the Laboratory Equipment as per the Schedule of requirements given in this Tender Document.

PREPARATION OF TENDER.

1. Language of Tender

The **Tender** alongwith any accompanying literature shall be prepared in **English** language only:

2. Submission of Tender

- a) The **Tender** shall be enclosed in a double cover. The outer cover shall bear the address of the Project Director, Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir's, Sindh, without any indication that it encloses a tender. The inner cover shall be marked with the title of the Tender, number of invitation to the Tender and the date of opening of the Tender, and **must be sealed**.
- b) The **Form for Tender**, (Annexure-A) **Tender Particulars (Annexure-B)** and **Forms of Schedule to Tender** (Annexure "C1"&"C2") enclosed herewith, shall be submitted in duplicate. The authorized person signing the tender documents must state his full name and authorized position designation underneath his signature.
- c) The **erasing and/or alterations**, if any, in the Tender shall be authenticated by the authorized person by his full signature.
- d) The **Tender** shall be accompanied with the **original quotations** from the manufacturers, in case the Tender is submitted through their authorized agents or distributors, and shall be supported by credentials establishing the experience and standing of the manufacturers and / or their authorized agents or distributors.
- e) **Ambiguous and incorrect answers** and/or incorrect filling of Tender Documents will render the tender liable to rejection.
- f) **Quotations** through cable, telegraph, telex, fax, or e-mail will not be considered.

- g) The tenders shall not rely on any **interpretation or correction** given by any person except the written **addenda and/or corrigenda** to documents issued by the Project Director, Mehran University of Engineering and Technology, Z.A Bhutto Campus Khairpur Mir's, Sindh.

3. Bid Bond and Contract Performance Bond

- a) The tenderer shall enclose with his/her tender a **Bid Bond** on requisite stamp paper, as per **Annexure "D"** to this Tender Document, issued by a scheduled/commercial bank doing business in Pakistan, for an amount equivalent to **2% of the total cost** of the Equipment offered as per the Tender submitted by him/her, or Rs.50,000.00 (fifty thousand), whichever is more. The Bid Bond shall be in favor of the Project Director, Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus, including his successor in office and assignees acting through the Project Director, Mehran University of Engineering and Technology, Z.A Bhutto Campus Khairpur Mir's. The bond so furnished shall remain **valid for a period 28 days beyond the period of validity of the Tender** or till it is revalidated/extended for a period mutually agreed upon by the tenderer and the Project Director, Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir's.
- b) As soon as an award is made, the provisions in paragraphs **c), d) and e)**, hereunder, shall **operate**.
- c) If the Tender is **rejected**, the Bid Bond will be returned to the tenderer as soon as possible after rejection.
- d) The **successful bidder** shall have to give a **Contract Performance Bond**, as per **Annexure "E"** to this Tender Document, to the extent of **10% of the total value** of the contract on the same conditions as the Bid Bond. The Performance Bond shall be retained by the Project Director, Mehran University of Engineering and Technology, Z.A Bhutto Campus Khairpur Mir's till the completion of the guarantee period as per Clause 23 of the Conditions of Contract.

4. Quality of Stores.

- a) The Equipment and other relevant materials (hereinafter called "**Stores**") quoted and supplied against this "Invitation to Tender" shall be strictly in accordance with the **Specifications** attached with this Tender Document. The Stores shall be the product of an established manufacturer shall conform to internationally acceptable commercial standards, and shall be a model that has been successfully operated over a reasonable period of time in educational institutions R&D organizations, or relevant industry.
- b) In Tenderers must also warrant the use of best material in the making of the stores. by the find that the Specifications for any items of the Stores are lacking in details, they may give their own proposals with detailed specifications, preferably three alternate proposals if possible, for such items in Annexure "F".

- c) The Stores offered by the tenders must be of a quality suitable for the purposes and operations for which they are required, and must be capable of rendering the required performance and services at site in the local conditions of extreme tropical climate, air, dust, water, power and fuel at Khairpur Mir's.
- d) The Hardware for operation of the Stores will be made available by the MUET, Z.A Bhutto Campus, Khairpur Mir's.
- e) The electric supply for operation of the Stores will be made available at 220 volt single phase, or 380 volt three phase, and 50 cycles.
- f) The Stores offered shall be complete with their standard accessories and must be accompanied by their normal instructions book/manual.
- g) Wherever possible or feasible, each item of Stores offered must have its own protection devices, e.g, overload protection by circuit breakers or fuses, or voltage stabilizer for electric equipment.
- h) Unless stipulated otherwise in the specifications for any item, the Stores conforming to ASA, SAE, SSI or DIN will be acceptable.
- i) The successful bidders may be asked to supply list of spares for 5 years satisfactory operation of any item of the Stores, prior to award of the contract.

5. Literature.

The tenderers must furnish with their bids catalogues giving full technical details of the Stores to enable the University to check their offers technically against the prescribed specifications failing which the offers will be liable to rejection.

6. Principals Name, Certificate and Invoice.

- a) The tenderers are required to mention in their quotations/offers the name and address of their Principals along with a certificate authorizing them (tenderers) to quote on their (Principals) behalf as under:
"This is to certify that M/S. _____ located at _____ have obtained quotations from us against tender inquiry No. _____ dated _____ from Mehran University of Engineering and Technology, Z.A Bhutto Campus, Khairpur Mir's, due for opening on _____ and have agreed to make available the Equipment on the quotations and terms and conditions of the tender".

The above condition does not apply to the manufacturers bidding directly.

- b) The tenderers must also furnish along with their offers their Principals original Proforma Invoice failing which their offers will be rejected.

7. Country of Origin.

The tenderers must state in his Tender the country of origin of the Stores offered.

8. Alternative Proposal.

If any tenderer elects to submit alternative proposal(s) complete information on the alternative items including all data relating to technical specifications in Vol. I, II&III shall be given as per Annexure "F".

9. **Prices.**a) **CATEGORY-‘A’ Stores Manufactured/Available in Pakistan without Involving Import.**

The prices quoted must be total per unit in Pakistani Rupees as shown in **Annexure “C-1”** and shall include:

- i. All charges for packing, marking, handling, insurance, inspection, guarantees, freight/transportation, agent’s commission; and all duties, taxes, levies, octrois etc; and.
- ii. The cost of installation, putting into operation and demonstration of the working of the Equipment in the Laboratories of the Campus.

b) **CATEGORY-“B”. Stores Imported from approved Countries.**

The prices must be quoted for each item of Stores in **Annexure-“C2”** separately for each of the PARTS given below:

PART-1. Payment in Foreign currency.

The C&F prices quoted by the Principals in the currency of the country of origin.

For the purpose of comparison, the prices quoted shall be converted to equivalent prices in Pakistani Rupees on the basis of the official bank rate prevalent on the date of opening of the Tender.

PART-2 Payment in Pakistani Rupees.

- (i) The agent’s/supplier’s commission in Pakistani Rupees.
- (ii) The insurance charges. The insurance will be arranged by the Contractor through the Campus with Pakistan Insurance Corporation. The Campus will assist the Contractor in obtaining the insurance at concessional rates, if any, as allowed by the Government.
- (iii) The cost of installation, putting into operation and demonstration of the working of the equipment in the Laboratories of the Campus in Pakistani Rupees.
- (iv) All the charges pertaining to handling and clearance of the Stores at the port including all taxes, levies, octrois etc. but excluding the customs duties for the payment of which the Campus is exempted by the Government. However, if the customs duties are charged for any items of the Stores for which the Government the exemption, the MUET, Shaheed Z.A Bhutto Campus, Khairpur Mir’s will make the payment.

- (v) The transportation charges for transporting the Stores from the port to the Laboratories of the Campus including the charges for loading the Stores at the port and unloading the same at the MUET, Shaheed Z.A Bhutto Campus, Khairpur Mir's.

For the purpose of evaluation/comparison of bids, as stated in Clause-15, the total price for the Stores under this Category shall be the sum of the amounts mentioned for Parts 1 & 2 above.

- (c) In addition to what is stated in para a) & b) above, the prices given in Annexure C1 & C2 shall also include the following for the Stores of both the Categories-A & B.
 - (i) Supply, detailing, manufacture, factory testing, export preparation and all costs incidental to shipping/transport up to the stage of installation in the Laboratories of the Campus.
 - (ii) Responsibility for any loss and/or damage at any stage from manufacture to installation in the Laboratories of the Campus.
 - (iii) Provision for clean on boards bills of landing.
 - (iv) The cost of export taxes, fees and charges levied and out going incurred on exporting goods in the country of origin.
 - (v) The expenses on account of the certificate of origin, invoices or any other documents issued in the country or origin.

10. Validity of Prices/Tender

- a) The prices quoted shall be valid for a period of at least 120 days from the date of opening of the tender.
- b) Until the final Contract is executed, the successful bidder shall be bound by the terms and conditions of this Tender Document.

11. Acceptance of the Terms

- a) The submission of the tender against this tender inquiry by the tenderer means that the tenderer has read and accepted the terms and conditions relating to all the tender documents and annexures, and that he/she has thoroughly examined the specifications and particulars in the tender inquiry. Further the tender shall be deemed to be fully aware of the nature of the Stores and the purpose for which they are required and shall be bound to accept the Contract if placed with him/her on the basis of the prices and of the delivery schedule as indicated in Clause 12 hereof within the validity of his/her Tender.

- b) If the Tender is awarded in favour of Proprietor/Principals who has no authorized agent or distributor in Pakistan, he/she shall have to appoint a distributor or nominee for the purpose of successful completion of the contract and to provide after-sales service.

12. Delivery Period.

i. Shipment of Imported Items.

- a) The shipment of the items of Stores which are to be imported shall be started as early as possible, the shipment schedule shall be submitted to the Project Director, MUET, Shaheed Z.A Bhutto Campus, Khairpur Mir's and shall be negotiable and subject to approval by the University.
- b) The tenderer must indicate in his/her offer the port from where the Stores will be shipped.

ii. Delivery Period.

- a) The entire Stores must be delivered, installed and put into operation in the Laboratories of the Campus as early as possible after receiving the letter of award of the Contract.
- b) The Tenderer shall give in the offer his/her own schedule for the delivery and installation of various items of the Stores which shall be negotiable and subject to approval of the University.

iii. Delay in the Delivery of the Stores.

- a) For the Stores delayed beyond the delivery period, as specified in the Contract, or as approved by the University as stated in Clause 12 ii b) above, there shall be levied liquidated damages as specified in Clause 22 of the Conditions of Contract given in this Tender Document.
- b) The liquidated damages may be waived fully or partially by the Project Director, with the approval of the Vice Chancellor of the University, if there are reasonable grounds for such a delay.

13. Negotiations.

Under no circumstances will the negotiations take place with any tenderer with regard to Specifications and Prices quoted and read out at the public opening of the tenders and with regard to the substance of the offer. The tenderers cannot revise their prices after the public opening of the tenders.

14. Rights of the Campus

- (a) The Campus reserves the right to reject any or all bids without any reason whatsoever, or not waive minor irregularities or errors in any offer. If it appears to the Campus that such irregularities or errors must be corrected in the offer in which they occur, the same will be corrected prior to issue of the letter of intent which may be awarded thereupon.

- (b) The Campus is neither bound to accept the lowest or any other offer nor is it bound to assign reason for rejection of any offer.
- c) The Campus reserves the right to award the contract to one bidder or divide it among several bidders.
- d) The Campus reserves the right to increase or decrease the quantity of the Stores at its discretion without assigning any reason whatsoever.
- e) The Campus reserves the right to cancel the offer of the tenderer whose bid has been found / evaluated to be the lowest if it is revealed to the Campus that the tenders does not have the capability or financial resources or facilities to carry out the Contract in accordance with the terms and conditions of this Tender Document.

15. Evaluation of Bids.

- a) In comparing bids the Campus will consider, besides the prices quoted, such other factors as compliance with specifications, relative quality of Stores, past experience of the tenderer, after-sales services facilities available in Pakistan and the tenderer's capacity to perform.
- b) The evaluation criteria specifically mentioned in the specifications will also be considered for evaluation of the bids.
- c) For the purpose of evaluation, the prices to be compared shall be the total prices inclusive of all duties, taxes, freight charges etc. as stated in clause 9 titled "Prices" above.
 - (i) For the items quoted in Annexure-C-1, the total prices as mentioned in Clause-9(b) shall be compared.
 - (ii) For comparison of the items quoted in Annexure C-1 with those quoted in Annexure C-2, the total prices as mentioned in Clause-9(a) including the charges/cost packing, making, handling, insurance, inspection guarantees, clearance, freight/transportation upto the Campus Laboratories duties, taxes, levies, octrois etc.

16. Errors in the Bids.

- (i) Any arithmetic errors found during evaluation of bids will be rectified on the following basis:
 - a) If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected by the University.
 - b) If there is a discrepancy between the words and figures, the amount in figures shall prevail.

- c) If there is any discrepancy between the total tender price entered in the Articles of Agreement and the total shown in the Schedule of Prices, the amount stated in the Articles of Agreement shall be corrected by the University in accordance with the corrected schedule of Prices.
- (ii) If the tenderer does not accept the corrected amount of tender, his/her Tender will be rejected and the Bid Bond submitted with the tender shall be forfeited.

17. **Foreign Exchange for Items of Stores to be imported.**

For the items of Stores which are to be imported and for which the prices have been quoted on C&F basis in Annexure C-2, the University will arrange payment in the foreign currency, to the extent of the C&F amount, as stated in Clause 9(b), through its bank in Pakistan in accordance with the prevailing foreign exchange control rules/regulations of the Government of Pakistan.

CONDITIONS OF CONTRACT

1. Scope of the Contract

- a) The **Scope of the Contract** shall be the supply, delivery, installation, putting into operation and demonstration of the working of the Stores in the Laboratories of the Campus at Khairpur Mir's, Sindh, in accordance with the technical Specifications and Bill of Quantities enclosed in this Tender Document.
- b) The Contractor shall within a period of one month of the execution of the agreement furnish to the University a **detailed program** for supply and delivery of various items of the Stores for necessary approval by the University.

2. Definition of Terms

In writing these Conditions of Contract, Specifications and Bill of Quantities, the following words shall have the meanings hereby indicated, unless there is some thing in the subject matter or Contract inconsistent with such constructions:

- i. **The University** shall mean the Mehran University of Engineering and Technology, Jamshoro, Sindh.
- ii. **The Campus** shall mean the Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir's, Sindh.
- iii. **The Pro-Vice Chancellor** shall mean the Pro-Vice Chancellor of Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir's, Sindh, including his successor in office and assignees, empowered to act in all matters pertaining to the University either directly or through the Project Director, Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir's.
- iv. **The Contractor or Supplier** shall mean the Tenderer (Bidder) whose Bid has been accepted by the University and shall include the Bidder's executors, administrators, successors and permitted assignees.
- v. **The Stores** shall mean and include all the Laboratory Equipment, literature, materials and articles to be provided by the Contractor under the Contract.
- vi. **The Contract** shall mean the agreement signed by the Contractor for the supply, delivery, installation, putting into operation and demonstration for the working of the Stores, as stated under the Scope of the Contract above.
- vii. **The Contract Price** shall mean the sum mentioned in or calculated in accordance with the provisions of the Contract, which is to be paid to the Contractor for satisfactory execution of the Contract in accordance with these Conditions of Contract.

- viii. **The Specifications** shall mean the specifications annexed to or issued, herewith, and shall include the schedule and drawings attached hereto as well as the samples and patterns if any.
- ix. **Month** shall mean the Calendar month.
- x. **Writing** shall include any manuscript, type-written, printed or other statement reproduced in any visible form and whether under seal or under hand.

3. **Contract Documents.**

- a) The term **Contract Document** shall mean the following documents which shall be deemed to form an integral part of the Contract:
 - i. Articles of Agreement;
 - ii. Instructions to Tenderers;
 - iii. Conditions of Contract;
 - iv. Contractor's Proposal / Offer including the relevant correspondences prior to signing of the agreement with all Annexures duly filled in;
 - v. The Specifications of the Stores; and
 - vi. Bill of Quantities with prices.
- b) In the event of any **conflict** between the above mentioned documents, the present Articles of Agreement and Conditions of Contract shall prevail.

4. **Signing of the Contract Agreement**

Within 30 days of the issue of the letter of intent, the successful bidder (bidders) will be required to **sign an agreement** with the University for the supply of such quantity, in whole or in part, of the tendered Stores as will be communicated to him / her (them) in the letter of intent.

5. **Packing, Marking and Handling**

- a) All the Stores, whether imported or locally manufactured / available, shall be delivered to the University at Khairpur Mir's in **safe and secure condition** at the risk and cost of the Contractor.
- b) The packing, marking and handling shall be so arranged by the Contractor as to **prevent any loss of or damage** to the Stores.

- c) In case any of the items of the Stores are to be imported by the Contractor, the **import** shall be **arranged by the Contractor** himself / herself with such packing and marking and through such means as deemed fit by him / her for safe and secure delivery at Khairpur Mir's. The packing of the equipment shall be the usual export packing to ensure safe journey by air, sea, rail and road, as the case may be, of the Stores to destination. Each packing shall be clearly marked in English with the following:

- i. Port of Destination: KARACHI.
 ii. Name of the Ship: _____
 iii. Name of the Consignee: PROJECT DIRECTOR
 MEHRAN UNIVERSITY OF
 ENGINEERING & TECHNOLOGY
 SHAHEED Z.A BHUTTO CAMPUS
 KHAIRPUR MIR'S SINDH, PAKISTAN

- i. Name of the Contractor: CONTRACTOR'S NAME & ADDRESS
 ii. Case Number & Contents: _____
 iii. Net Weight & Dimensions: (length, Breadth & Height)
 iv. Gross Weight: (Kg.)
 v. Number & Date of Contract: _____
 vi. Marking: **MUET, SHAHEED Z.A BHUTTO CAMPUS**
 in a 6 in. x 4 in. rectangle

MUET, SHAHEED Z.A BHUTTO CAMPUS

6. Transportation and Shipment

a. For Stores to be Imported

- i. All those items of Stores which are to be imported by the Contractor shall be **shipped** by whatever means the Contractor deems fit **at his / her risk and cost**. The Contractor must keep the University informed of the shipping arrangements, schedule of shipping, arrival at the port, clearance from the port, and transportation from the port to the Campus at Khairpur Mir's.
- ii. **All costs** of loading of the Stores from the wharves at port of shipment and also the cost of ship wharf age / berthing, demurrage charges, stevedoring, handling charges and other port and river dues in respect of shipment companies' vessels at the port of shipment and all other expenditure up to the stage of placing the Stores at rest on board the ship and the freight charges shall be **borne by the Contractor**.
- iii. Similarly all costs of unloading the Stores at the wharves, wharf age / berthing, demurrage, stevedoring, handling charges and other port dues at the port of arrival in Pakistan and transportation from the port up to the stage of placing the Stores position in the laboratories of the Campus shall be borne by the **Contractor**. In order to facilitate the clearance of the Stores at the port of arrival, a clearing agent will be engaged by the University, in consultation with the Contractor, who will get the Stores cleared with the assistance of the University and the Contractor, and the clearing agent's charges shall be **borne by the Contractor**.

- iv. All things being equal, **Pakistan flag ships** should be used, as far as possible, for shipment of the Stores. If no such ship is available, such other ships may be used consistent with the execution of this Contract with economy and efficiency.
- v. The Stores must be shipped **under deck**
- vi. The Contractor shall send by air mail/courier service or personally deliver 4(four) sets of non-negotiable shipping documents direct to the Project Director, Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir's, Sindh, so as to reach him at least 8(eight) days before arrival of the ship at the port in Pakistan.

b. For Stores Manufactured / Available in Pakistan

- i. All those items of the Stores which are to be manufactured in Pakistan, or are to be supplied from the locally available stocks (whether imported or manufactured in Pakistan), may be transported from the place of manufacture or availability to Khairpur Mir's by **any mode of transportation** as deemed convenient and suitable by the Contractor at his / her risk and cost.
- ii. **All costs** of handling, loading, transportation, unloading and placing the Stores in position in the Laboratories of the Campus shall be **borne by the Contractor**.

7. Pre-shipment and After-fabrication Inspection

- a) The **pre-shipment inspection** and / or the inspection of the Stores Principals/Proprietor at the premises, if desired by the Contractor, shall be arranged by the Contractor at his / her own cost. The responsibility for the quality, quantity, correctness and adherence to the Specifications etc. of the Stores shall lie solely and squarely on the Contractor.
- b) The Campus may, at its discretion, waive pre-shipment inspection and hence issue the waiver in writing so that the Stores could be shipped under manufacturer's test certificate. This waiver shall be deemed as authorization to ship for the purpose of negotiating the letter of credit under Clause 13(b) ii.
- c) The pre-shipment inspection and/or the waiver thereof shall in no any above the Contractor of any of his obligations under this Contract.

8. Insurance

The **Contractor shall arrange** the insurance for the Stores in whatever way he / she deems fit at his / her risk and cost. The prices quoted in the offer of the Contractor shall include the cost of insurance. The Contractor shall have to inform the University of the Insurance Arrangements made by him / her for the Stores.

9. On-arrival Inspection

There shall be inspection of the Stores by the representatives of the University after arrival in the laboratories of the Campus in presence of the Contractor or his authorized representatives and the representatives of the insurance company. The **inspection report**, which, inter-alia, should indicate the condition in which each item of the Stores has been received, shall be signed by the above representatives. The Contractor shall coordinate with the Project Director, Mehran University, and the insurance company for arranging the inspection at such date and time as is convenient to the above representatives.

10. Taking Over

Upon receipt of the equipment in the Laboratories of the Campus and after inspection, as stated in Clause 9 above, the Campus will issue a **taking-over certificate** in respect of those items of Stores which are received in acceptable condition. The taking-over of the damaged items will be with-held until the same are repaired / replaced and are re-inspected and found in acceptable condition.

11. Installation and Demonstration of Stores

a). Installation

- i) After inspection and taking over of the Stores, as stated in Clauses **9** and **10** above, the **Contractor shall install** those items of Stores which are to be permanently positioned in place in the laboratories of the Campus. For this purpose, the Contractor shall co-ordinate with the Project Director, Mehran University, for making arrangements for the Hardware needed for the installation.
- ii) The cost of hardware **for installation** shall be borne by the Campus. The Contractor shall provide, alongwith his offer, the details of the hardware needed for each item of the Stores separately. The technical and other personnel needed for installation of the Stores shall be provided by the Contractor at his cost. The entire cost of installation, configuration, application except that of the needed hardware, shall be borne by the Contractor.

b) Demonstration

- i) After installation of the Stores, as stated in Clause **11 a)** above, the complete **working of each item** of Stores for the purpose of performing the intended Laboratory experiments, testing of specimens and recording of the test results etc., shall be demonstrated fully to the designated staff of the Campus by the Contractor or his technical personnel.
- ii) The entire **cost**, including the T.A. / D.A. of the personnel involved in the demonstration, shall be **borne by the Contractor**.

12. Completion Certificate

After completion of the installation and demonstration, as stated in Clause **11** above, a certificate is to be obtained by the Contractor from the concerned **Head of the Department** stating that the Stores (item-wise) have been satisfactorily installed and demonstrated by the Contractor.

13. Terms of Payment

The Contractor shall be paid for Stores in the following manner:

- a) CATEGORY A: **Stores Manufactured/Available in Pakistan without involving import.**
 - i. For all those items of Stores for which the completion certificate has been issued by the Campus, as stated in Clause **12** above, the Campus will pay to the Contractor total price of the items quoted by the Contractor.
 - ii. The payment for those items of Stores for which the completion certificate has not been issued by the Campus, as stated in Clause **12** above, will be with-held and released only after the damaged items are replaced / repaired, re-inspected and found in satisfactory condition with consequent issuance of the completion certificate. The payment will be made in the same manner as stated in Clause **13 a) i** above
- b) CATEGORY-B **Stores Imported from Approved Countries.**

The payment for this category of Stores will be made in two parts as under:-

PART-I. Payment in Foreign currency

- i. An irrevocable **letter of credit** of one hundred percent (**100%**) of the C&F price, in the currency quoted by the Principals, will be opened in a bank in the country of origin in favor of the Principals/Contractor within 30 days after signing the Contract.

- ii. One hundred percent (**100%**) of the letter of credit amount will be paid against presentation of the shipping documents to the bank through the above letter of credit. The required shipping documents include:
- Clean on board bill of lading;
 - Contractor's detailed invoice showing description of the Stores, specifications, quantity, unit price and total price;
 - Detailed packing list;
 - Certificate of origin of the Stores' and
 - Certificate of pre-shipment/after-fabrication inspection or authorization to ship the Stores as per Clause-7.

PART-2. Payment in Pakistani Rupees

The Rupee component of the price of the Stores, as stated in Clause **9 b)** of “**Instructions to Tenderers**” will be paid to the Contractor in the following manner:

- i. For all those items of Stores for which the taking over certificate has been issued by the Campus, as stated in Clause **10** above, the Campus will pay to the Contractor seventy percent (70%) of the total price of the items quoted by the Contractor, the remaining thirty percent (30%) will be paid after presentation of the completion certificate, as stated in Clause 12 above. Whereas the payment in Pakistani Rupees against the inland expenses for the items of stores procured under category-B shall be paid vice versa i.e 30% at the time of taking over certificate and remaining 70% will be paid after presentation of the completion certificate.
- ii. The payment for those items of Stores for which the completion certificate has not been issued by the Campus, as stated in Clause **10** above, will be withheld and released only after the damaged items are replaced/repared, re-inspected and found in satisfactory condition with consequent issuance of the completion certificate. The payment will be made in the same manner as stated in Clause **13 a)i** above

14. Warranty / Guaranty

- a) The Contractor shall **warranty** that the Stores shall be fit for the purposes and operation mentioned in the relevant clauses of the “Instructions to the Tenderers” and “Conditions of Contract”, notwithstanding the fact that the entire Stores, or any item or part of the Stores, bear or are found to bear a patent or trade mark.
- b) The Contractor shall guarantee supply of good quality Stores in accordance with the Specifications and as stated in Clauses 4 and 5 of the “Instructions to the Tenderers”. Further, the Stores shall be brand new and absolutely free from all defects in material, quality and workmanship. In case of defects, the defective Stores, or the defective parts / components of the Stores thereof, shall be replaced by the Contractor free of cost to the Campus within reasonable time.

15. Breach of Contract

In case of breach of warranty /guarantee or Contract, the **damages** suffered by the Campus shall be **recovered from the Contractor** out of any payment due to the Contractor and / or in accordance with the terms and conditions of the Contract Performance Bond given at Annexure “E” enclosed with this Tender Document, without notice to the Contractor.

16. Contractor’s Default Liability

- a) The University may upon written notice of default to the Contractor **terminate the Contract** in the circumstances detailed hereunder:
 - i. If in the judgment of the University, the Contractor fails to make delivery of the Stores within the time specified in the Contract Agreement or within the period for which extension has been granted by the University; and
 - ii. If, in the judgment of the University, the Contractor fails to comply with any of the other provisions of the Contract.
- b) In the event the University terminates the Contract, in whole or in part, as provided in Clause **16 a)** above, the University reserves the right to **purchase**, on such terms and conditions as it may deem appropriate, Stores similar to the one terminated, and the Contractor will be liable to the University for any additional costs for such **similar Stores**, and / or for liquidated damages for delay, as defined in Clause **22** of the Conditions of Contract until such reasonable time as may be required for the final supply of the Stores.
- c) If the Contract is terminated, as provided in Clause **16 a)** above, the University, in addition to any other rights provided in this Clause, may require the Contractor to **transfer title** and deliver to the University under any of the following cases in the manner and as directed by the University:
 - i) Any **completed Stores**; and
 - ii) Such **partially completed Stores**, drawings, information and contract right (hereinafter called manufacturing material) as the Contractor has specifically produced or acquired for the performance of such parts of the Contract as has been terminated.
- d) The Campus will **pay to the Contractor** the Contract Price for the completed Stores delivered to and accepted by the Campus and also for the manufacturing materials delivered and accepted.
- e) In the event the University does not terminate the Contract, as provided in Clause **16 a)** above, the Contractor shall continue with the performance of his / her Contract, in which case the Contractor shall be liable to the Campus for **liquidated damages for delay** as set out in Clause 22 until the Stores are accepted.

17. Bankruptcy

If the **Contractor** shall become **bankrupt** or have a receiving order made against him / her or compound with his / her creditors, or being a corporation commence to be wound up, not being a voluntary winding up for the purpose of amalgamation or reconstruction, or carry on its business under a receiver for the benefit of its creditors or any of them, **the University shall** be at liberty to:

- a) **terminate the Contract** forthwith by a notice in writing to the Contractor or to the liquidator or receiver or to any person in whom the Contract may become vested, and to act in the manner provided in Clause 16 above as though the last mentioned notice has been the notice referred in such Clause and the Stores have been taken out of the Contractor's hand; and / or
- b) give such liquidator, receiver, or other person the **option of carrying out the Contract** subject to his / her providing a guarantee for the due and faithful performance of the Contract upto an amount to be determined by the University.

18. Termination of Contract

- a) If, for any cause as set forth in Clause **19** hereafter, the Contractor finds it impracticable to continue operation or, if owing to force majeure or to any cause beyond its control, the Campus finds it impossible to continue operation, then **prompt notification** in writing shall be given by the party affected to the other.
- b) If the delay or difficulties so caused cannot be expected to cease or become avoidable, or if operation cannot be resumed within six months, then either party shall have the right to terminate the Contract by giving ten **(10) days written notice** to the other.
- c) In the event of termination of the Contract under this Clause, **payment** will be made to the Contractor as follows:
 - i) The Contractor shall be paid for all the Stores for which the completion certificate has been issued, as stated in Clause 12, and for all the reimbursable expenses due and unpaid.
 - ii) The Contractor shall also be paid reasonably for any work done during the said six months period as well as for settlement of any financial commitment made in connection with proper performance of the Contract and which are not reasonably defrayed by payments under i) above.
 - iii) On termination of the contract for any cause, the Contractor shall see to the orderly suspension and termination of operations with due consideration to the interests of the Campus with respect to completion, safeguarding or storing of the Stores produced for the performance of the Contract and the salvage and resale thereof

19. Force Majeure.

The Contractor shall not be liable for any additional cost or for liquidated damages for delay or any failure to perform the Contract arising out of force majeure or cause beyond his / her control including acts of God, or of the public enemy, or of the Government, fires, floods, epidemic quarantine restrictions, strikes, freight embargoes and default of subcontractors due to any such cause (unless the Campus shall determine that the Stores to be furnished by the Contractor might reasonably have been obtained from other sources in sufficient time to allow the Contractor to meet the required time schedule), provided that the Contractor shall within ten (10) days from the beginning of such delay notify the Campus in writing of the **causes of the delay**. The Campus shall ascertain the facts and the extent of the delay and **extend the time** for completing the supplies as in its judgment the findings justify.

20. Rejection

- a) In the event any portion of the Stores supplied by the Contractor is found before taking over to be **defective in material or workmanship**, or otherwise not in conformity with the requirements of the Contract, the University shall have the right to either reject or require, in writing, rectification of the Stores. In the later case, the Contractor shall with utmost diligence, and at his own expense, make good the defects so specified or replace the defective Stores. If the Contractor fails to rectify or replace the rejected Stores, the University may adopt any of the following options:
- i) **replace or rectify**, at its option, such defective Stores and charge to the Contractor the excess cost occasioned to the University plus (15%) fifteen percent; or
 - ii) acquire the said Stores **at a reduced price** considered equitable under the circumstances; or
 - iii) **terminate the Contract** as provided in Clause **18** of these Conditions of Contract.
- b) Nothing in this Clause shall affect any claim by the University under Clause **22** hereafter.

21. Extension of Time

If the completion of the Contract is delayed due to reason beyond the control of the Contractor, the Contractor shall without delay request the University, in writing, of his **claim** for an extension of time. The University on receipt of such request may agree to **extend the completion date** as may be reasonable in the circumstances of the case but without prejudice to other terms and conditions of the Contract.

22. Delay in Delivery - Liquidated Damages

- a) Should the **progress** of the Contract at any time be **lagging behind** the program agreed between the University and the Contractor, the University will notify the Contractor in writing and the Contractor shall there upon take such steps as he / she may deem fit to **expedite the progress** of the Contract. Non-issuance of this notice by the University shall not in any way absolve the Contractor of the liquidated damages as stated in Clause **22 b)** below.
- b) If the Contractor **fails to complete the Contract**, in full or part, within the time laid down in the Contract Agreement or any extension thereof, there shall be deducted from the Contract Price, as **liquidated damages**, a sum of one half of one percent (**0.5%**) of **the Contract price** of each unit of the delayed Stores for each calendar week of delay subject to the maximum of five percent (5%) of the Contract Price of the unit or units so delayed, and such deduction shall be in full satisfaction of the Contractor's liability for the said failure.

23. Period of Guarantee

- a) The term **period of guarantee** shall mean the period of twelve (**12**) **months** from the date on which the Stores have been put into operation and demonstrated to Campus staff. In any case this period shall not exceed eighteen (18) months from the date of taking-over certificate.
- b) During the period of guarantee, the Contractor shall **remedy**, at his / her expense, **all defects** in design, materials, and workmanship that may develop or are revealed under normal use of the said Stores upon receiving written notice from the Campus; the notice shall indicate in what respect the Stores are faulty.
- c) The provisions of this Clause include all the **expenses** that the Contractor may have to incur for delivery and installation of such replacement parts, material, and equipment as are needed for satisfactory operation of the Stores at the Campus premises.

24. Non-assignment

The Contractor shall **not have the right to assign or transfer** without the prior approval of the University the benefit and obligations of the Contract or any part thereof.

25. Expenditure Under Contract

The Contractor shall not make any expenditure for the purpose of this Contract in any **country not authorized** by the Government of Pakistan

26. Certificate Not to Affect the Rights of the University or the Contractor

No certificate of the University on account nor any sum paid on account by the Campus nor any extension of time for the delivery of the Stores pursuant to Clause 19 shall affect or **prejudice the rights of the University** against the Contractor nor relieve the Contractor of his obligation for due performance of the Contract or be interpreted as approval of the Stores supplied, and no certificate shall create liability of the Campus to pay for the alterations, amendments, variations etc. not ordered in writing by the University or discharge the Contractor for the payment of damages or of any sum against the payment of which he / she is bound to indemnify the Campus nor shall such certificate nor the acceptance by him / her of any sum paid affect or **prejudice the rights of the Contractor** against the Campus.

27. Payments Due from the Contractor

All costs, ascertained damages or expenses for which under the Contract the Contractor is liable to the Campus may be deducted by the Campus from any money due or may become due to the Contractor under the Contract or may be recovered by action of law or other wise from the Contractor.

28. Legal Proceedings

The Contract and the Tender Documents are governed by the **laws of Pakistan** and no proceedings to or arising out of any of them shall be instituted in any courts other than those situated at Hyderabad and Karachi, Sindh Pakistan..

29. Dispute

Should any question or dispute arise as to the material, design, construction or delay in the supply of the Stores or the purpose or the performance for which they are required or are warranted, the Campus shall nominate an independent **certifier / expert** having knowledge of laboratory equipment, etc., who will, after affording the parties to the dispute an opportunity to present their contention, and after having tests made as the certifier deems fit, certify whether there has been any breach of Contract or warranty and, if so, what sum shall be paid to the Campus in diminution or extinction of price, and such certificates shall be final and binding and shall not be questioned and shall be acted upon in arbitral or other legal proceedings. The award of the costs of the certifier will be within his / her own discretion and shall be recoverable from the party against which the costs are awarded.

30. Arbitration

All disputes and matters of difference whatsoever (other than those relating to the certificate of expert certifier) between the University and the Contractor relating to and arising out of the Contract and Tender Documents shall be referred to arbitration under the arbitration act 1940 with amendments and re-amendments thereof, each party nominating its own arbitrator. The umpire will be nominated by the arbitrators within the first three arbitral hearings. The **award of the arbitrators or of the umpire shall be final and binding** upon the parties. The arbitral proceedings shall be held at Khairpur Mir's, Sindh Pakistan.

FORM OF TENDER
(LETTER OF OFFER)

Tender Reference No. _____ Dated _____

Name of Contract: **Supply, Installation, Putting into Operation and Demonstration of Equipment in the Laboratories of Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir's, Sindh**

The Project Director
Mehran University of Engineering & Technology
Shaheed Z.A Bhutto Campus Khairpur Mir's SINDH.

Dear Sir,

1. Having examined the Tender Documents including Instructions to Tenderers, Conditions of Contract, Specifications, Drawings, Schedule of Prices and Addenda Nos. _____ for the execution of the above-named Contract, we, the undersigned, being a company doing business under the name and address _____ and being duly incorporated under the laws of Pakistan hereby offer to execute and complete such Contract and remedy any defects therein in conformity with the said Documents including Addenda thereto for the Total Tender Price of Rs. _____ (in figures and words) or such other sum as may be ascertained in accordance with the said Documents.
2. We understand that all the Schedules attached hereto form part of this Tender.
3. As security for due performance of the undertakings and obligations of this Tender, we submit herewith a Bid Bond referred to in Clause 3 of the Instructions Tenderers and as per Annexure "D", in the amount of Rs. _____ (in words and figures) drawn in favor of or made payable to Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir's, and valid for a period of 28 days beyond the period of validity of this Tender.
4. We undertake, if our Tender is accepted, to complete the whole of the work comprised in the above-named Contact within the time stated in Clause 12 of the Instructions to Tenderers.
5. We agree to abide by this Tender for the period of 120 days beyond the date of opening of the Tender, and it shall remain binding upon us and may be accepted at any time before the expiration of this period.
6. Unless and until a formal Contract Agreement is signed, this Tender, together with your acceptance thereof, shall constitute a binding contract between us.
7. We undertake, if our Tender is accepted, to execute the Contract Performance Bond referred to in Clause 3 of the Instructions to Tenderers and as per Annexure "E" for the due performance of the Contract.

8. We understand that you are not bound to accept the lowest or any Tender you may receive.
9. We do hereby declare that this Tender is made without any collusion, comparison of figures or arrangement with any other person or persons making a Tender for the above-named Contract.
10. We confirm, if our Tender is accepted, that all partners of the joint venture shall be liable jointly and severally for the execution of the Contract and the composition or the constitution of the joint venture shall not be altered without the prior consent of the Pro-Vice Chancellor, Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir's. (Please delete this clause in case of Tender from a single firm)

Dated this _____ day of _____ 2011

Signature _____ in the capacity of _____ duly authorized

to sign Tender for and on behalf of _____
(Name of Tenderer in Block Capitals)

Address: _____

Witness:

Name: _____

Address: _____

Occupation: _____

TENDER PARTICULARS

THE TENDERERS MUST SUPPLY THE FOLLOWING SPECIFIC INFORMATION FOR EACH ITEM OR GROUP OF ITEMS OF THE STORES:

1. Conformation of Stores:

Whether the Stores offered conform to the particulars specified in the Schedules; if not, details of deviations must be stated in Annexure "F".

2. Manufacturing Details:

- (i) Brand of Equipment.
- (ii) Name and address of Manufacturer; and
- (iii) Country of origin of Stores.

3. Delivery Schedule: `

- (i) Earliest date by which delivery can be effected;
- (ii) Complete schedule of delivery; and
- (iii) If the delivery period is different for different items, it must be indicated item wise.

4. Packing Specification:

Whether the specifications for packing given in the Tender Documents will be adhered to.

ANNEXURE "C1"

FORM OF SCHEDULE TO TENDER FOR STORES
MANUFACTURED/AVAILABLE IN PAKISTAN WITHOUT INVOLVING IMPORT.

Due by _____ hours on _____ _____ _____
(time) (date) (month) (year)

SCHEDULE TO TENDER NO. _____ DATED _____

The Tender will be opened at _____ hours on _____ _____ _____
(time) (date) (month) (year)

Delivery on or before _____ _____ _____
(date) (month) (year)

Rates and amount to be quoted in Pakistani Rupees

S.No.	Code/ Item No.	Description Of Stores	Detailed Specifications Of Stores with Model No.	Quantity Of Stores.	Unit	Rate Per Unit	Total Price.
1	2	3	4	5	6	7	8

It is certifies that:

- i) The Stores offered above conform in all respects with the particulars/specifications given in the Tender Documents' and
- ii) All the terms and conditions of the Tender Documents are acceptable to us.

(signature of the authorized person)

SEAL

(name of the authorized person)

(name of the Tenderer)

FORM OF SCHEDULE TO TENDER FOR STORES
IMPORTED FROM APPROVED COUNTRIES.

Due by _____ hours on _____
 (time) (date) (month) (year)

SCHEDULE TO TENDER NO. _____ DATED _____

The Tender will be opened at _____ hours on _____
 (time) (date) (month) (year)

Delivery on or before _____
 (date) (month) (year)

PART 1. The rates quoted in the Table below must be on C&F basis.

S. No.	Code/ Item No.	Description Of Stores	Detailed Specifications Of Stores with Model No.	Quantity Of Stores.	Unit	Rate Per Unit	Currency	Total C&F Price	Country of Origin
1	2	3	4	5	6	7	8	9	10

PART 2. The rates quoted in the Table below must be in Pakistani Rupees

S.No.	Code/ Item No.	Description of Stores	Quantity Of Stores.	Unit	Rate Per Unit	Total Price.
1	2	3	5	6	7	8

(Continued on the next page)

ANNEXURE “C2”

NOTE:

In the Table below, the columns 1 to 5 and 8 are to be filled in by the Tenderer before submitting the Tender, while the columns 6,7 and 9 are to be filled in jointly by the Project Director, Mehran University of Engineering and Technology, or his representative, and the Tenderer, or his representative, after opening of the Tender.

S. No.	Code/ Item No.	Description of Stores	Total C&F Price for Part 1	Currency	Exchange Rate	Total Price for Part 1 (Rs.)	Total Price for Part II (Rs.)	Total Cost (Rs.)
1	2	3	4	5	6	7	8	9

It is certified that:

- i) The Stores offered above conform in all respects with the particulars/specifications given in the Tender Documents; and
- ii) All the terms and conditions of the Tender Documents are acceptable to us.

(name of the Tenderer)

(signature of the authorized person)

SEAL

(name of the authorized person)

BID BOND

(Bank Guarantee)

Guarantee No _____
Executed on _____
Expiry date _____

Letter by the Guarantor (Bank) to the Employer (University)

Name of Guarantor (Bank) with address: _____

Name of Principal (Tenderer) with address: _____

Penal sum of Security (Bond),(in figures and words): _____

Tender Reference No. _____ Date of Tender _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Tender and at the request of the said Principal (Tenderer), we the Guarantor above-named are held and firmly bound unto the Pro-Vice Chancellor, Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir’s, acting through the Project Director, Mehran University of Engineering and Technology, {hereinafter called The “Employer” (“University”)} in the sum stated above, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severely, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal (Tenderer) has submitted the accompanying Tender numbered and dated as above for supply, installation, putting into operation and demonstration of equipment in the laboratories Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir’s, to the said Employer (University); and

WHEREAS, the Employer (University) has required as a condition for considering the said Tender that the Principal (Tenderer) furnish a Bid Bond in the above said sum to the Employer (University), conditioned as under:

- 1) that the Bid Bond shall remain valid for a period of 28 days beyond the period of validity of the Tender;

2) that in the event of;

- a) the Principal (Tenderer) withdraws his Tender during the period of validity of the Tender;
- b) the Principal (Tenderer) does not accept the correction of his Tender Price, pursuant to Clause 16 of “Instructions to Tenderers”; or
- c) failure of the successful Tenderer to:
 - i) furnish the required Contract Performance Bond, in accordance with Clause 3 of “Instructions to Tenderers”; or
 - ii) sign the proposed Contract Agreement, in accordance with Clause 4 of the “Conditions of Contract”;

then the entire sum be paid immediately to the said Employer (University) as liquidated damages and not as penalty for the successful Tenderer’s failure to perform.

NOW THEREFORE, if the successful tenderer shall, within the period specified therefore, on the prescribed form presented to him for signature enter into a formal Contract with the said Employer (University) in accordance with his Tender as accepted and furnish within twenty eight (28) days of his being required to do so, a Contract Performance Bond with good and sufficient surety, as may be required, upon the form prescribed by the said Employer (University) for the faithful performance and proper fulfillment of the said Contract or in the event of rejection of the said Tender by the Employer (University) within the time specified then this obligation shall be void and of no effect, but otherwise to remain in full force and effect.

PROVIDED THAT, the Guarantor shall forthwith pay to the Employer (University) the said sum stated above upon first written demand of the Employer (University) without cavil or argument and without requiring the Employer (University) to prove or to show grounds or reasons for such demand notice of which shall be sent by the Employer (University) by registered post duly addressed to the Guarantor at its address given above.

PROVIDED ALSO THAT, the Employer (University) shall be the sole and final judge for deciding whether the Principal (Tenderer) has duly performed his / her obligations to sign the Contract Agreement and to furnish the required Contract Performance Bond within the time stated above, or has defaulted in fulfilling the said requirements and the Guarantor shall pay without objection the sum stated above upon first written demand from the Employer (University) forthwith and without reference to the Principal (Tenderer) or any other person.

IN WITNESS WHEREOF, the above bounden Guarantor has executed the instrument under its seal on the date indicated above, the name and seal of the Guarantor being hereto affixed and these presents duly signed by its undersigned representative pursuant to the authority of its governing body.

Guarantor (Bank)

Witness:

1. _____
(Signature)

(Signature)

(Name, Title, Address and Seal)

(Name)

2. _____
(Signature)

(Title)

(Name, Title, Address and Seal)

(Corporate Guarantor Seal)

CONTRACT PERFORMANCE BOND
(Bank Guarantee)

Guarantee No. _____
Executed on _____
Expiry Date _____

Letter by the Guarantor (Bank) to the Employer (University)

Name of Guarantor (Bank) with Address: _____

Name of Principal (Contractor) with address: _____

Penal Sum of Security (Bond), (in words and figures) _____

Letter of Acceptance No. _____ Dated _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the Tender Documents and above said Letter of Acceptance (hereinafter called the Documents) and at the request of the said Principal (Contractor) we, the Guarantor above named, are held and firmly bound unto the Pro-Vice Chancellor, Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir’s, Sindh, acting through the Project Director, Mehran University of Engineering and Technology {hereinafter called the Employer (University)} in the penal sum of amount stated above for the payment of which sum well and truly to be made to the said Employer (University), we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal (Contractor) has accepted the Employer’s (University’s) above said Letter of Acceptance for the supply, installation, putting into operation and demonstration of Equipment of Laboratories of Mehran University of Engineering and Technology, Shaheed Z.A Bhutto Campus Khairpur Mir’s, Sindh.

NOW THEREFORE, if the Principal (Contractor) shall well and truly perform and fulfill all the undertakings, covenants, terms and conditions of the said Documents during the original terms of the said Documents and any extensions thereof that may be granted by the Employer (University), with or without notice to the Guarantor, which notice is hereby waived and shall also well and truly perform and fulfill all the undertakings, covenants, terms and conditions of the Contract and of any and all modifications of the said Documents that may hereafter be made, notice of which modifications to the Guarantor being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue till the expiry of the guaranty period as per Clause 23 of the Conditions of Contract.

Our total liability under this Guarantee is limited to the sum stated above and it is a condition of any liability attaching to us under this Guarantee that the claim for payment in writing shall be received by us within the validity period of this Guarantee, failing which we shall be discharged of our liability, if any, under this Guarantee.

We, _____ (the Guarantor), waiving all objections and defenses under the Contract, do hereby irrevocably and independently guarantee to pay to the Employer (University) without delay upon the Employer's (University's) first written demand without cavil or arguments and without requiring the Employer (University) to prove or to show grounds or reasons for such demand any sum or sums up to the amount stated above, against the Employer's (University's) written declaration that the Principal (Contractor) has refused or failed to perform the obligations under the Contract which payment will be effected by the Guarantor to the Employer's (University's) designated Bank and Account Number.

PROVIDED ALSO THAT the Employer (University) shall be the sole and final judge for deciding whether the Principal (Contractor) has duly performed his obligations under the Contract or has defaulted in fulfilling the said obligations, and the Guarantor shall pay without objection any sum or sums up to the amount stated above upon first written demand from the Employer (University) forthwith and without any reference to the Principal (Contractor) or any other person.

IN WITNESS WHEREOF, the above bounden Guarantor has executed this Instrument under its seal on the date indicated above, the name and corporate seal of the Guarantor being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body

	_____ Guarantor (Bank)
Witness:	
1. _____ (Signature)	_____ (Signature)
_____ Name, Title and Address (Seal)	_____ (Name)
2. _____ (Signature)	_____ (Title)
_____ Name, Title and Address (Seal)	_____ Corporate Guarantor (Seal)

ANNEXURE "F"

Statement Describing Deviation from Specifications.

S.No.	Code No.	Description of Stores	Statement of Variation from Specifications	Reasons for Variations.
1	2	3	4	5

(signature of the authorized person)

(name of the authorized person)

SEAL

On behalf of

(name and address of the Tenderer)

**LABORATORIES OF ELECTRICAL ENGINEERING
DEPARTMENT**

ITEM CODES

**EL/BAEL, EL/EML,
EL/ICL, EL/CSL &
EL/ACL**

I. BASIC & ADVANCE ELECTRONICS LAB

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/BAEL-01	Oscilloscope 50MHZ-200MHZ (-3db) 60 MHZ Digital Stoarge Features 60MHz Bandwidths 1GSa/s Real-Time Sample Rates Maximum, 25GSa/s Equivalent-Time 2Mega Point Record Length 2mV~10V Vertical Scale up to 600V peak input 1ns~50s Horizontal Range Up to 27 Automatic Measurements Versatile Math Functions + , -, x, FFT, FFTrms 5.6" TFT LCD Display USB Interface & SD Card Supported Multi-Language Support on Operation Menu & On-Screen Help As per literature attached	4		
EL/BAEL-02	Function Generator (Advanced Direct Digital Synthesis(DDS) technology, 2 output channels, built-in counter, 20MHz maximum output frequency (5 MHz max square wave)	2		
EL/BAEL-03	Digital Multi-meter True RMS-AC (upto 20 KHz) Digital Multimeter OP RS-232 Cable & S/W OP USB Adapter	6		
EL/BAEL-04	Computer ((6M Cache, up to 3.80 GHz)or abaove) 4GB RAM with Mother Board Support for Serial and parallel Ports. Monitor and all other required Acessories	1		
EL/BAEL-05	Workplace First Aid Kits Burn Relief Dressing 10cm x 10cm Dependaplast Washproof Assorted Plasters Eye Pad Sterile Dressing Finger Dressing with Adhesive Fixing First Aid Guidance Leaflet Foil Blanket Large Sterile Dressing Medium Sterile Dressing Microporous Tape 2.5cm x 10m Nitrile Gloves (pairs) Reliform Conforming Bandage Reliwipe Moist Cleansing Wipe Resuscitation Face Shield with valve Safety Pins Sterile Eyewash (250ml) Triangular Sterile Bandage Universal Shears - small 6"	1		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/BAEL-06	AMPLIFICATION MODULE Linear amplification of current, voltage and power BJT amplifiers: EC, CC and BC configurations Thermal stability of a linear amplifier Static and dynamic load line Intermediate stage – final stage pre-amplifiers Power amplifiers in class A Power amplifiers in class B Power amplifiers in class C Fault simulation	10		
EL/BAEL-07	TRANSISTOR AMPLIFIER CIRCUITS Idea of linear amplification of current, voltage and power Common base configuration: Common emitter configuration: Common collector configuration (emitter follower): Circuits for the control of alternate current motors Thermal and bias stabilization of a linear amplifier Static and dynamic load lines Multi-stage amplifiers RC coupled amplifiers Transformer coupled amplifiers Direct-coupled amplifiers Fault simulation	10		
EL/BAEL-08	TRANSISTOR POWER AMPLIFIERS BJT power amplifiers Classification of the outputstages Harmonic distortion Heat dissipation Amplifiers in class A Amplifier with load flown by direct current Amplifier with output transformer (single-ended power amplifier) Phase splitter Amplifiers in class B Push-Pull amplifiers Transformer amplifiers in class B Output stage in class B (complementary power amplifiers) Single-ended amplifiers in class B Darlington configuration amplifiers Fault simulation	10		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/BAEL-09	<p>OPERATIONAL AMPLIFIERS</p> <p>Ideal operational amplifier Concept of common mode and differential voltage The negative feedback Main operational amplifier linear configurations Concept of virtual mass Inverting and non-inverting configuration Inverting summing amplifier Zero and different from zero level detector Differential amplifier Integrator and derivator 741 operational amplifier The meaning of CMRR, Vos and slew rate Comparators, ramp and square wave generators Comparator circuit Transfer characteristics Inverting Schmitt trigger Square wave generator Ramp generator 555 integrated circuit as astable and monostable multivibrator Fault simulation</p>	10		
EL/BAEL-10	<p>POWER AMPLIFIERS</p> <p>Typical problems relevant to power devices Power amplifier parameters Classification of the output stages Harmonic distortion Heat dissipation Main circuit configurations Class A amplifiers Amplifiers with load run by direct current Amplifier with output transformer Class B output stage Fault simulation</p>	10		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/BAEL-11	OPERATIONAL AMPLIFIER Ideal Operational Amplifier The operational Amplifier The negative Feedback Main Configurations Of The Linear Circuits Idea Of Virtual Mass Inverting Configuration NonInverting Configuration Buffer IV And V/I Inverter Inverting Adder NonInverting Adder Differential Amplifier NonLinear Circuits Comparators Comparator With Hysteresis Inverting Comparators NonInverting Comparators Reference Voltage Different From Zero Comparator With Hysteresis Or Schmitt Trigger Fault Simulation	10		
EL/BAEL-12	OPERATIONAL AMPLIFIER APPLICATIONS Attenuator Integrator Differentiator Low Pass & Filter High Pass & Filter Band Pass & Filter Full Wave Bridge Driver/Conversion The Ideal Operational Amplifier The Negative Feedback Concept Of Virtual Ground Inverting Configuration Not Inverting Configuration Integrator Differentiator Electrical Filters Parameters Of The Filters Transfer Functions Of The Filters Active Filters VCVS Filters Multiple Feedback Band-Pass Filter Full Wave Bridge Driver/Conversion Voltage Current Converter Bridge Rectifier The Rectifier Instrument Fault Simulation	10		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/BAEL-13	SIGNAL FILTERS Astable -Multivibrator Bistable -Multivibrator UJT Pulse Generator O.A With Constants Parameters Integrator Differentiator Difference Amplifier Astable,Bistable, Multivibrator Circuits The UJT Transistor Ideal Circuit With Operational Amplifier Fault Simulation	10		
EL/BAEL-14	FILTER CIRCUITS Integrator Differentiator LowPass Filter HighPass Filter BandPass Filter Notch Filter Ceramic Filter Operational Amplifier Circuit With Inductor And Capacitor Active Filter Study Of Notch Filter Study Of Ceramic Filter Fault Simulation	10		
EL/BAEL-15	MOTORS, GENERATORS AND CONTROL Motors Stepper Motor PWM- Power Stage Synchronous Stepper Motor Power Stage Set Point and PWM Generator Linear Stepper Sequence Direct Current Motors Generators Circuits for The Control Of Direct Current Motors Alternate Current Motors Circuits for the Control Of Alternate Current Motors Stepping Motors Circuits for the Control Of Stepping Motors Fault Simulation SCR TRIAC Control	10		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/BAEL-16	POWER SUPPLY REGULATION CIRCUITS Diodes Shunt Voltage Regulator Variable Ic Voltage Regulator Circuit Protect Ac/Dc Converter Dc/Ac Converter Switching Regulator Must Cover Following Diodes Circuits Voltage Regulator With Transistor Variable Ic Voltage Regulator With Overload Protection Ac/Dc Conversion Dc/Ac Conversion Switching Regulator	10		
EL/BAEL-17	TRANSDUCERS FUNDAMENTALS Reference Supply Heater IC Transducer Thermistor Instrumentation Amplifier 4-20ma Transmitter RTD Thermocouple Strain Gauge Capacitive Sensor Ultrasonic Transducers Infrared Controller Measurement Of Temperature Through an Integrated Circuit Transducer Measurement Of Temperature Through A Current Output Integrated Circuit Transducer Measurement Of Temperature Through a Thermocouple Measurement Of Temperature Through a Thermo Resistance Measurement Of Temperature Through a Thermistor Measurement Of The Deformation Through an Instrumentation Amplifier Reception Of Ultrasonic Signals Capacitive Sensors Infrared Transmission	10		
EL/BAEL-18	REGULATIONS AND CONTROLS Control and regulation, Types of controls, Automatic regulation systems, Proportional regulation (P), Integral regulation (I), Derivative regulation (D), Proportional-Integral-Derivative regulation (PID), ON-OFF regulation, PWM regulation, Characteristics of the transducers, Position transducers, Speed transducers, Pressure transducers, Temperature transducers, Thermistors, Actuators, Dc motors, Peckling motors. Fault simulation. It must be possible to perform the following experiences: Encoder, Closed loop and open loop speed control, Temperature sensor, Heater characteristic measurement, Temperature ON-OFF control, Temperature closed loop proportional control, Temperature closed loop proportional-integral control, Position sensor, Position closed loop control, Pressure sensor, Pressure closed loop proportional-integral control. The faults must be inserted by software and by micro switches mounted on the board.	10		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/BAEL-19	<p>Application for REGULATION AND CONTROL MODULE</p> <p>MOTOR SPEED CONTROL</p> <p>It must be possible to perform the following experiences: characteristics of an encoder and operation of an open loop and closed loop system.</p>	10		
EL/BAEL-20	<p>Application for REGULATION AND CONTROL MODULE</p> <p>TEMPERATURE CONTROL</p> <p>It must be possible to perform the following experiences: characteristics of the temperature sensor, Measurement of the heater characteristics, ON-OFF control of the temperature, Closed loop proportional control of the temperature, Closed loop proportional-integral control of the temperature.</p>	10		
EL/BAEL-21	<p>Application for REGULATION AND CONTROL MODULE</p> <p>POSITION CONTROL</p> <p>It must be possible to perform the following experiences: characteristics of the position sensor and closed loop control of the position.</p>	10		
EL/BAEL-22	<p>Application for REGULATION AND CONTROL MODULE</p> <p>PRESSURE CONTROL</p> <p>It must be possible to perform the following experiences: characteristics of the pressure sensor, closed loop proportional-integral control of the pressure.</p>	10		
EL/BAEL-23	<p>BASE FRAME WITH POWER SUPPLY, VIRTUAL INSTRUMENTATION</p> <p>0/+15 Vdc, 1 A 0/-15 Vdc, 1 A +15 Vdc, 1 A -15 Vdc, 1 A +5 Vdc, 1 A -5 Vdc, 1 A 6 - 0 -6 Vac, 1 A</p> <ul style="list-style-type: none"> • Interface board for connection to PC. • Robust structure and modern design. • Voltage regulation and protection against over voltage or short circuit. • The base frame must be supplied complete with a set of connecting cables,USB HID managed <p>MAIN BLOCKS</p> <p>Virtual instrumentation</p> <p>Multimeter</p> <ul style="list-style-type: none"> • 3 and 3/4 digits • dc/ac voltage 400mV, 4 V, 40 V, 400 V • resistance: 400 Ohm, 4 kOhm, 40 kOhm, 400 kOhm,40 MOhm • dc/ac current: 200 mA, 8A <p>Function Generator</p> <ul style="list-style-type: none"> • sinusoidal, square , triangular, dc • frequency: 0.1Hz - 200 kHz • output: ± 10 V • attenuator: 0 dB, -10 dB, -20dB • frequency, amplitude, offset, duty-cycle regulation 	10		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
	Digital oscilloscope <ul style="list-style-type: none"> • dual trace oscilloscope • input: dc/ac, 1 MOhm • measurement ranges: 20/50/100/200/500 mV, 1/2/5V per division • sampling frequency: 100 Hz to 10MHz Digital Pattern Generator TTL Output, Logic Wave Analyzer			
EL/BAEL-24	Microprocessor Kit 1 High performance 8085A CPU @ 3 MHz. 1 4 K powerful monitor FIRMWARE. Including all standard commands, codes, functions and utility subroutines. 1 2 K user RAM 6116. 1 Three 28 pin sockets provided for memory expansion upto a maximum of 56 K. 1 Versatile Keyboard/Display controller using 8279. 1 46 parallel I/O lines, 22 from 8155 and 24 from 8255. 1 Serial I/O through autoadjusting type RS-232 channel. 1 Built-in audio cassette interface. 1 Programmable timer. 1 Powerful 8085 interrupt capabilities. 1 6 digit seven segment LED display. 1 Highly reliable multi-function keypad. 1 All address, data and control and hardware interrupt lines are brought out on a 50 pin FRC connector for system interfacing and expansion. 1 Three 16 bit Timer/Counter channels are available on-board, using 8253. 1 These channels are available on a 10 pin FRC connector. 1 RAM sockets are provided with battery back up. 1 Supplied in attractive polished wooden enclosure.	5		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/BAEL-25	<p>Networks and Bridges Trainer</p> <p>Must demonstrate following</p> <ul style="list-style-type: none"> • Demonstrates the basic theorems • Demonstrates the two port network parameters • Demonstrates the different AC bridges • Analysis of network <p>Must have following</p> <ul style="list-style-type: none"> • On-board Power supply, Resistor, Capacitor, Inductor bank • On board dual isolated power supply 0 to 24 V. • Variable Current source. • Resistor bank • Capacitor bank (fixed and variable) • Inductor bank • Potentiometer bank • Bread board • Interconnection points and test points • Experimental manual • Interconnection cord 	10		
EL/BAEL-26	<p>Electronics Constructor Kits</p> <p>Each kit must contains of manual for student assignments and a selection of components, which must be supplied in a separate storage box. Must offers facilities for the rapid and easy assembly of all types of circuit, with provision for discrete components, digital and analogue integrated circuits and high power devices. Must have robust and reliable circuit connectors incorporated in the kit to allow the user to assemble a circuit almost as quickly as it can be designed. The logical layout of the components must aid comprehension of the theoretical principles involved. The kit must be provided with all required d.c. and a.c. power supply inputs, all of which can be provided by a separate power supply unit. In case the power supply unit is provided separate it must be included in the item and must be provided for all individual kits.</p> <p>Circuit constructor Kit must be provide with discrete componrnrs for following areas of knowledge:</p> <ul style="list-style-type: none"> • Basic Electricity and Electronics • Amplifiers and Electronic CircuiApplications • Power Supplies • Electronic Control of Machines • Optoelectronics 	10		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/BAEL-27	<p>Demonstration Console</p> <p>The base console must be multifunctional, compact having measuring interface. It must be used for the operation and as a power supply to the modular KITS/ experiment boards. The base console must ensure connectivity to the PC via USB Port/or Ethernet for the recording of measurements and its built-in functions. The base console must ensure easy and quick attachment to an experiment board(s) and/or any experiment board carrier. Must have clear and structured design resulting in easy operation.</p> <p>The base console must have following characteristics:</p> <ul style="list-style-type: none"> • 4-channel oscilloscope • Digital multi-meter • Digital Analyser • Function Generator • Frequency Counter • Integrated USB interface for external measuring instruments <p>The base console must be provided with experimental board(s) which can be used to demonstrate the following practicals.</p> <ul style="list-style-type: none"> • Incandescent lamp characteristic • VDR characteristic • Diode characteristic • LDR characteristic • NTC characteristic • PTC characteristic • RC circuits • Inductance • Moving coil instrument • Batteries 	10		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/BAEL-28	<p>AC Technology Demonstration Kit</p> <ul style="list-style-type: none"> • Generating alternating voltages • Key parameters of AC technology • Ohmic resistance in an AC circuit • Coils in an AC circuit • Inductive reactance • Series RL circuits • Parallel RL circuits • Capacitors in an AC circuit • Capacitive reactance • Series RC circuits • Parallel RC circuits • Series RLC circuits • Parallel RLC circuits • Series compensation • Parallel compensation • Voltage resonance • Current resonance • Characteristics of a three-phase system • Representation of line diagrams and phase relationships • Star- and delta circuits with different loads • Measurement of phase and line voltage/current • Ohmic load • Symmetrical and unsymmetrical charges • Measurement of power in the three-phase system <p>Complete with Set of Safety Cables all necessary prerequisite items</p>	5		
EL/BAEL-29	<p>Assembly Kits</p> <p>Modular based Assembly kits for Electronic must be designed to help build and implement student's own circuits, it must consist on</p> <ul style="list-style-type: none"> - Development board. - Power supply connector. - Digital visual display unit. - Logical source. - Set of potentiometers. - Pulse generator and inverters. - Interrupter. - Clock. <p>Must have discrete components to study following topics:</p>	10		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
	1.- Frequency response. 2.- Low-pass filter. 3.- High-pass filter. 4.- LC Circuit. 5.- Study of Error in Low-pass filter. 6.- Study of Error in High-pass filter. 7.- Filter with double T link. 8.- Generator circuit of the signal S1. 9.- Study of Error in RC filter with double T. 10.- Low-pass filter. 11.- Low-pass filter with load and operational amplifier. 12.- High-pass filter. 13.- High-pass filter with load and operational amplifier. 14.- The attenuation is cumulative. 15.- Use of Operational Amplifier. 16.- Study of Faults in filters. 17.- Behaviour of the filter. 18.- Filter of distorted signal. 19.- Filter in cascade; low pass filter and high pass filter. 20.- RC net oscillator. 21.- LC net oscillator. 31 Faults study with RC and LC Net oscillators. 32- Wien Bridge. 33 Fault study in the Wien bridge oscillator. 34.- Colpitts oscillator. 35 Hartley oscillator. 36 Faults study with the Colpitts oscillator. 37 Astable multivibrator. 38 Fault study with an Astable multivibrator. 39 555 timer. 40- 555 timer fault study.			

II. ELECTRICAL MACHINES LAB

EL/EML-01	Oscilloscope 50MHZ-200MHZ (-3db) 60 MHZ Digital Storage Features 60MHz Bandwidths 1GSa/s Real-Time Sample Rates Maximum, 25GSa/s Equivalent-Time 2Mega Point Record Length 2mV~10V Vertical Scale up to 600V peak input 1ns~50s Horizontal Range Up to 27 Automatic Measurements Versatile Math Functions + , -, x, FFT, FFTrms 5.6" TFT LCD Display USB Interface & SD Card Supported Multi-Language Support on Operation Menu & On-Screen Help As per literature attached	4		
EL/EML-02	Digital Multi-meter True RMS-AC (upto 20 KHz) Digital Multimeter OP RS-232 Cable & S/W OP USB Adapter	6		
EL/EML-03	Laser photo tachometer tester RPM motor	1		
EL/EML-04	Phase Sequence/ Motor Rotation Tester PRM4	1		
EL/EML-05	Flux Meter(Ac/Dc) (measuring range: 103,104, and 5 kilo Maxwell turns)	1		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/EML-06	Mechanics Tool Kit / Set - Sockets, Screwdrivers, Pliers, Wrenches & MORE	1		
EL/EML-07	Computer ((6M Cache, up to 3.80 GHz)or abaove) 4GB RAM with Mother Board Support for Serial and parallel Ports. Monitor and all other required Aecessories	1		
EL/EML-08	AC Series motor	2		
EL/EML-09	RELUCTANCE MOTOR Power: 450 W • Voltage: 3 x 400 Vac- 50 Hz (*) • RPM: 3000 (*) (2 poli) • Form of construction: IMB3 • Protection: IP44 • This unit also includes thermal protector • Dimensions: 440 x 160 x 250 mm	2		
EL/EML-10	REPULSION START INDUCTION SINGLE-PHASE MOTOR • Power: 200 W, • Voltage: 42 V 50 Hz (*) • R.p.m.: 0-3000 (*), • Form of construction: IM B3 • Protection: IP 22, • This unit also includes thermal protector, • Dimensions: 440 x 160 x 250 mm	2		
EL/EML-11	TESTING PANEL OF AUTOMATIC POWER FACTORCORRECTION SYSTEM • Painted metallic framework with fore panel of insulating material• Quick connections via safety leads and terminals (Ø 4 mm)• 1 automatic microprocessor controller of power factor,with rated voltage of 380-415 V – 50-60 Hz- ammeter input with forward current up to 5 A (sensitivity range 0, 125 ... 6 A)- setting power factor: 0.8 ind ... 0.8 cap., reconnection time: 5 ... 240 s- sensitivity range: 5...600 s/step - 5 relay outputs with contacts of 5 A – 250 Vac- setting parameters manually from display-assisted keyboard• 2 multi-function instruments; auxiliary power supply:115-230 V; 3 lines of 3 seven-segment displays (red LED of 13 mm)- measurements of voltages, currents, active, reactive and apparent powers, and power factor in single-phase and three-phase systems - accuracy rating for currents and voltages: ± 1%- measuring range: 5 A – 850 V max. • 1 four-pole rotary switch of operation – 16 A – 400 V• 1 set of three fuse holders with gl-type fuses 10.3x38 of 6 A• 1 pair of fuse holders with gl-type fuses 10.3x38 of 2 A• 1 fuse holder with gl-type fuse 10.3x38 of 4 A• 1 noise suppression fi lter for three-phase line with neutral• 1 battery of three-phase capacitors of 450 V~ with selectionswitch between 4 and 8 µF and relevant discharging resistors of 50 kΩ - 10 W• 1 battery of three-phase capacitors of 450 V~ with selectionswitch among 4 8, and 16 µF and relevant discharging resistors of 50 kΩ - 10 W	2		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/EML-12	Flex Stand General Data, Height 1170 mm , Weight 9 kg	2		
EL/EML-13	5kV Insulation Tester (Megohmmeter) 5KV MegOhmMeter MegOhmMeter Digital Insulation Tester Includes Low leakage probes and test leads Alligator Clips Cable and interface adapter FlukeView software Line cord Soft carrying case with waterproof bottom Users manual 1550B MegOhmMeter Digital Insulation Tester Features Test voltages of 250, 500, 1000, 2500, and 5000 Volts	1		
EL/EML-14	Hysterisis motor (AC Synchronous motor 230V AC 50/60Hz 5RPM)	2		
EL/EML-15	Shaded pole motor (V=230, No Load speed = 2779 rpm, output P=2.38 W, T=8.87mNm	2		
EL/EML-16	Induction Motor 2 Speed 2 Windings General Data 50 HzPower 0.8 / 1.0 kW Speed 930 / 1440 rpm Voltage 220-240 3-phase Current 4.7 / 6.0 A Dimensions 450 x 300 x 340 mm Shaft height 162 mm	2		
EL/EML-17	Workplace First Aid Kits Burn Relief Dressing 10cm x 10cm Dependaplast Washproof Assorted Plasters Eye Pad Sterile Dressing Finger Dressing with Adhesive Fixing First Aid Guidance Leaflet Foil Blanket Large Sterile Dressing Medium Sterile Dressing Microporous Tape 2.5cm x 10m Nitrile Gloves (pairs) Reliform Conforming Bandage Reliwipe Moist Cleansing Wipe Resuscitation Face Shield with valve Safety Pins Sterile Eyewash (250ml) Triangular Sterile Bandage Universal Shears - small 6"	1		

III. INSTRUMENTATION AND CONTROL LAB

EL/ICL-01	Lux Meter <ul style="list-style-type: none"> • Stores up to 99 file locations • Logger function (3000 readings) • Multi-point or timed mean calculation • Meas. range 0 to +100000 Lux • Accuracy ±1 digit 	1		
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Item Code	Description of Equipment	Qty	Unit Price	Total Cost
	Accuracy to DIN 5032, Part 6: f1 = 8% = V (Lambda) adaptation f2 = 5% = cos like rating • Resolution 1 Lux (0 to +32000 Lux) 10 Lux (0 to +100000 Lux) • Oper. temp. 0 to +50 °C • Storage temp. -20 to +70 °C • Battery life 50 h PC RS232 interface			
EL/ICL-02	Clamp-on PQ Meter with Total Harmonics Distortion measurement TRMS sensing Power Quality Clamp Meter AC/DC current: Clamp-on measurement of ac current up to 1400 A rms and dc current up to 2000 A without breaking the circuit Highest safety rating: 600 V CAT IV power analyzer is rated for use at the service entrance Accurate in noisy environments: Clamp meter performs even with distorted waveforms present on electronic loads with low-pass filter	1		
EL/ICL-03	Electromechanical Single phase Energy meter KWH Meter Model with 2 CT's Delta system Meters require 2 ea. CT's ratio up to 400 amp, solid core round with 1" window Ratio must be specified at time of ordering. 1ea. CD 3234-2-(CT ratio)	1		
EL/ICL-04	Electromechanical three phase Energy meter Energy Meter 3 Phase self contained 8 digit electric meter. Combined kWh energy measurement, amp draw, power per phase and run time in one 96mm package. Field selectable CT and PT ratios, replaces the need for rotating disc meters with sockets and separate instantaneous wattmeter's. Microprocessor controlled circuitry provides up to class 1.0 accuracy, displayed via 8 digit LED counters and a standard RS485 port. Resolution to 0.25 Watts. Promotional price for a limited time. 1ea. EM6433	1		
EL/ICL-05	Digital Power Meter Simultaneous Display of W, A, V (PF or Hz) True RMS V, A, W Auto Calibration Via Computer Max. / Min. / Hold Function High Immunity to External Noise CT Ratio (1 ~ 9999) PT Ratio (1 ~ 9999)	2		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
	Asper literature attached			
EL/ICL-06	Power Factor Meter Three-phase instrument, symmetric load. Measuring range cap. 0.5 ... 1 ... 0.5 ind. Current range 0-5 A, Voltage range 220 V ± 20 % 3-phase Frequency range 40-65 Hz, Accuracy class 1.5 Dimensions 220 x 117 x 125 mm	2		
EL/ICL-07	Frequency Meter Measuring range 46-54 Hz Accuracy class 0.5 Dimensions 220 x 117 x 90 mm	2		
EL/ICL-08	Max-well wan bridge	2		
EL/ICL-09	Reactive power meter (KVAR Meter)	2		
EL/ICL-10	Analogue Power factor meter For both single-phase and three-phase, Phase Angle Scale included Excellent current characteristic: 20 - 200% of rated current (short time period) Wide range of applicable voltages: 60 - 300 V AC	2		
EL/ICL-11	Potential meter for calibration of dc instruments	2		
EL/ICL-12	A.C. Single phase, two wire solid state (static) fully electronic energy meters accuracy class 1.0 & current rating 5-30 A, with backlit LCD display for 240 Volt power factor range of Zero lag – unity – Zero lead	2		
EL/ICL-13	3 – Phase 4 – Wire Static Whole Current Energy Meter Class of accuracy : 1.0 S (No drift in tolerance of accuracy with time) (Meter should record energy at 1% Ib at UPF preferably with an error band + 2%) Supply Voltage : 240V, (– 40% to + 20%) Frequency : 50 Hz + 5% Current Range (basic) : 10A for 10 – 60A Maximum Current : 60A Starting Current : 0.2% of Ib at UPF Power factor range : Zero (lagging) – Unity – Zero (Leading) Power Loss : Voltage Circuit Less than 1.5W / 10VA per phase : Current Circuit Less than 4VA Resistance to impulse voltage : Minimum 10KV peak Resistance to surge voltage : Minimum 8KV peak of 1.2/50 Micro sec. Test Voltage at 50 Hz for 1min : 4 KV rms – as per IS 13779 Clock time accuracy : + 3 min/year – as per CBIP Tech Rep 88	1		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/ICL-14	Computer ((6M Cache, up to 3.80 GHz)or abaove) 4GB RAM with Mother Board Support for Serial and parallel Ports. Monitor and all other required Aecessories	1		
EL/ICL-15	Mechanics Tool Kit / Set - Sockets, Screwdrivers, Pliers, Wrenches & MORE	1		
EL/ICL-16	Workplace First Aid Kits Burn Relief Dressing 10cm x 10cm Dependaplast Washproof Assorted Plasters Eye Pad Sterile Dressing Finger Dressing with Adhesive Fixing First Aid Guidance Leaflet Foil Blanket Large Sterile Dressing Medium Sterile Dressing Microporous Tape 2.5cm x 10m Nitrile Gloves (pairs) Reliform Conforming Bandage Reliwipe Moist Cleansing Wipe Resuscitation Face Shield with valve Safety Pins Sterile Eyewash (250ml) Triangular Sterile Bandage Universal Shears - small 6"	1		
EL/ICL-17	Light Meter Measurements of light intensity to 200k lux or 18580 footcandles CIE photopic spectral response Data hold function temporarily freezes value on screen MIN, MAX and MAX/MIN functions Average function LCD Display Measurement rate of once per second	1		
EL/ICL-18	Colour LED Light Meter Foot-candle (Fc) Range 40, 400 4000, 40000 Lux Range 400, 4000, 40000, 400000 LED Type white, red, yellow, green, blue, purple Basic Accuracy $\pm 3\%$	1		
EL/ICL-19	Analogue Sound Level Meter Measuring Range=50 - 126dB Typical Measuring Accuracy= ± 2.0 dB (@ 114dB)	1		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/ICL-20	<p>Differential Pressure</p> <p>mbar Range: ± 200 Highest resolution: 0.01</p> <p>Pa Range: ± 9999 Highest resolution: 1</p> <p>hPa Range: ± 200 Highest resolution: 0.01</p> <p>kPa Range: ± 20 Highest resolution: 0.001</p> <p>PSI Range: ± 3.0 Highest resolution: 0.001</p> <p>mm Hg Range: ± 150 Highest resolution: 0.01</p> <p>mm Wg Range: ± 2100 Highest resolution: 0.01</p> <p>in Wg Range: ± 80 Highest resolution: 0.01</p>	1		
EL/ICL-21	<p>Calibration Meter</p> <p>The calibration meter must be suitable for verifying the calibration of Megger and Foster oil test sets. The meter must enable the high voltage output to be checked, and be suitable for all recent laboratory models of Megger and Foster oil dielectric strength test sets. The design must ensure that the load to the transformer is similar to the load during an oil dielectric strength test. The voltage indication must be viewed on an analogue display marked from 0 to 100 kV with 2 kV divisions. The scale also shows pass tolerance bands to enable a quick assessment of the accuracy to be made.</p>	1		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/ICL-22	<p>Cable Length Meter 4 1/2 digit LCD 19999 digits 0 - 2000m +/- 2% rdg + 5 digits 0.05 - 500mm² (1 - 28 AWG) 0.5 - 2000Î© +/- 2% rdg + 5 digits</p>	1		
EL/ICL-23	<p>The earth leakage clamp meter The earth leakage clamp meter with resolution down to 0.01mA and a basic accuracy of 0.05mA. Must have comparison feature which allows values between 1mA and 20mA to be set. Must have alarm to indicate falut. Must have a low pass filter eliminates frequency's above 150Hz avoiding false readings. Features: 4 Digit display Eliminate Tripping RCD's Auto Hold 150Hz Low Pass Filter High Resolution (0.01mA) Earth leakage comparison with audible alarm. AC mA: 0-30 - 300mA AC A: 0-30 - 60A AC V: 300V & 600V</p>	1		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/ICL-24	<p>Power Quality Monitor</p> <p>Measured Parameters</p> <p>(4) Differential Voltage: 16 bit resolution 0-1000Vrms, AC/DC, +/- 0.1% reading +/- 0.05% FS IEC 61000-4-30 Class A: 40-1000Vrms, ±0.1 % of U_{din}, range of 10% ~ 150% of U_{din} Transients – High Speed: 10-2000Vpk, +/- 10% of reading, +/- 0.5%FS Transients – rms: 0-1400Vpk, ±0.2 % of U_{din} (4) Current (rms): 512 s/c, 16 bit resolution Range probe dep., AC/DC, +/- 0.1% reading +/- 0.05% FS, ±0.2 % of U_{din} Transients – High Speed: Range probe dep., 10% of Reading, +/- 0.5%FS Transients – rms: Range probe dep., ±0.2 % of U_{din} Frequency: 10 sec window 16-25Hz, 41-69Hz, +/- 0.01Hz</p> <p>Calculated Parameters</p> <p>Power/Energy – 1 Second sampling</p> <p>Real Power (W) – P: meets 0.2S requirements, range probe dep. Apparent Power (VA) – S: meets 0.2S requirements, range probe dep. Reactive Power (var) – Q: meets 0.2S requirements, range probe dep. Power Factor (W/VA) -”true” 1 to 0 to 1 Displacement PF 1 to 0 to 1 Demand (in W): meets 0.2S requirements, range probe dep. Energy (in Wh): meets 0.2S requirements, range probe dep. Distortion – 200ms, 3 sec, 10 min windows V_{thd}: 0-100%, +/- 5% for V_{>=1%} V_{nom}, V Ind Harm: DC, 2-127, +/- 5% for V_{>=1%} V_{nom} I_{thd}: 0-100%, +/- 5% for V_{>=1%} V_{nom}, I Ind Harm: DC, 2-63, +/- 5% for V_{>=1%} V_{nom}</p> <p>Misc.</p> <p>P_{st} – 10 minutes: 0.2-10, +/- 0.05 @ P_{st}=1 P_{lt} – 2 hours: 0.2-10, +/- 0.05 @ P_{st}=1</p>	1		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/ICL-25	<p>Power Quality and Energy Analyzer</p> <p>Volt Vrms (ac+dc) Measurement range 1 V to 1000 V phase to neutral Resolution 0.01 V Accuracy ± 0.1% of nominal voltage Vpk 1 Vpk to 1400 Vpk Voltage Crest Factor (CF) 1.0 > 2.8 Vrms½ 1 V to 1000 V phase to neutral Vfund 1 V to 1000 V phase to neutral Amps (accuracy excluding clamp accuracy) Amps (ac +dc) 5 A to 6000 A Apk 8400 Apk A Crest Factor (CF) 1 to 10 Hz 42.50 Hz to 57.50 Hz Power Watts (VA, var) max 6000 MW Phase Angle -360° to +0° Flicker Plt, Pst, Pst(1min) Pinst 0.00 to 20.00 Unbalance Volts % 0.0 % to 20.0 % Amps % 0.0 % to 20.0 %</p>	1		
EL/ICL-26	<p>Earth Ground Tester Kit</p> <p>Measuring limits of error: method Full wave rectification Measuring range 1 V to 50 V Display range 0.0 V to 50 V Resolution 0.1 V Frequency range dc/ac 45 Hz to 400 Hz sine Accuracy ± (5 % of rdg + 5 digit) Measuring sequence Approx. 4 measurements/s Internal resistance Approx. 1.5 MΩ Max. overload Urms = 250 V Measuring limits of error: method Measurement of oscillation period of the interference voltage Measuring range 6.0 Hz to 400 Hz Display range 16.0 Hz to 299.9 Hz to 999 Hz Resolution 0.1 Hz to 1 Hz Range 1 V to 50 V Accuracy ± (1 % of rdg + 2 digit) Earthing Resistance (RE) Measuring method Current and voltage measurement with probe as IEC61557-5 Open circuit voltage 20/48 V, ac Short circuit current 250 mA ac Measuring frequency 94, 105, 111, 128 Hz selected manually or automatic. (AFC) 55 Hz in function R* Noise rejection 120 dB (16 2/3 , 50 , 60, 400 Hz) Max. overload Urms = 250 V Measuring range 0.020 Ω to 300 kΩ Display range 0.001 Ω to 2.999 Ω 3.00 Ω to 29.99 Ω 30.0 Ω to 299.9 Ω 300 kΩ to 2.999 kΩ 3.00 kΩ to 29.99 kΩ 30.0 kΩ to 299.9 kΩ Resolution 0.001 Ω 0.01 Ω 0.1 Ω 1 Ω 10 Ω 100 Ω Accuracy ± (2 % of rdg + 2 digit) Operating error ± (5 % of rdg + 5 digit)</p>	1		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost																
EL/ICL-27	<p>Earth Ground Clamp Meter</p> <p>Storage temp. range -20 °C to 60 °C (-4°F to 140 °F)</p> <p>Reference temp. range 23 °C ± 5 °C (73 °F ± 9 °F)</p> <p>Storage humidity <75 % Rh</p> <p>Operating humidity <85% Rh</p> <p>Display 999 digital LC display with special symbols</p> <p>Protection IP30 according to IEC 529/EN 60529</p> <p>Safety 300 V, CAT III pollution degree 2 IEC 61010-1 and IEC 61010-2-032</p> <p>Weight 750 g (1.165 lbs)</p> <p>Conductor size 35 mm (1.38 in) approximately</p> <p>Dimension (length x width x depth) 276 mm x 100 mm x 47 mm (10.8 in x 3.9 in x 1.9 in)</p> <p>Emission IEC 1000 4-2, IEC 61326-I class B</p> <p>Immunity IEC 61000-4-2, 8 kV (air) criteria A IEC 61000-4-3, 3 V/m performance criteria A</p> <p>Range selection AutoOverload indicator "OL" on display Measuring time 0.5 sec Measuring frequency 3.333 kHz Ground Loop Resistance (Autorange) Range Accuracy (± % of reading)</p> <table border="0"> <tr> <td>Ω)0.025 - 0.250 Ω</td> <td>± 1.5 % rdg ± 0.02 Ω</td> <td>0.250 - 9.999 Ω</td> <td>± 1.5 % rdg ± 0.05 Ω</td> </tr> <tr> <td>10.00 - 99.99 Ω</td> <td>± 2.0 % rdg ± 0.3 Ω</td> <td>100.0 - 199.9 Ω</td> <td>± 3.0 % rdg ± 1.0 Ω</td> </tr> <tr> <td>200.0 - 400.0 Ω</td> <td>± 5.0 % rdg ± 5 Ω</td> <td>400.0 - 600.0 Ω</td> <td>± 10 % rdg ± 10 Ω</td> </tr> <tr> <td>600.0 - 1500 Ω</td> <td>± 20 %</td> <td></td> <td></td> </tr> </table>	Ω)0.025 - 0.250 Ω	± 1.5 % rdg ± 0.02 Ω	0.250 - 9.999 Ω	± 1.5 % rdg ± 0.05 Ω	10.00 - 99.99 Ω	± 2.0 % rdg ± 0.3 Ω	100.0 - 199.9 Ω	± 3.0 % rdg ± 1.0 Ω	200.0 - 400.0 Ω	± 5.0 % rdg ± 5 Ω	400.0 - 600.0 Ω	± 10 % rdg ± 10 Ω	600.0 - 1500 Ω	± 20 %			1		
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600.0 - 1500 Ω	± 20 %																			

VI. COMMUNICATION SYSTEMS LAB

EL/CSL-01	<p>Analog Communication & Digital Communication</p> <p>Educational Laboratory Virtual Instrumentation Suite able to perform computer based Test & Measurement Academic Platform</p> <p>(Include Oscilloscope, Function generator, Digital multimeter, Arbitrary waveform generator, Bode analyzer, 2-wire current voltage analyzer, 3-wire current voltage analyzer, Dynamic signal analyzer, Impedance analyzer, Digital reader, Digital writer, Variable power supply.</p>	10		
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Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/CSL-02	Modulation & Coding Work Board PAM Modulator PAM Demodulator PPM Modulator PPM Demodulator DPSK Modulator DPSK Demodulator FHSS Spread Spectrum Encoder FHSS Spread Spectrum Decoder PCM Demodulator PCM Modulator	10		
EL/CSL-03	Fiber Optic Education Fiber optic communication is one of the most popular technologies in the modern days due to its high transfer speed and large capacity. uses fiber optic as a transmission media for the whole experiment. With four different data transmission ways (self module transmission, module-to-module transmission, PC-to-module transmission, and module-to-PC trans-missions) and various different modulation/demodulation methods (CVSD, FSK, etc.) introduced in the training system, users can obtain a very clear view of how Fiber-optic transmission works	5		
EL/CSL-04	Telephony Traning system PCM switching matrix, space-time-space Flash stored control program 2 PCM frames, 30 channels each Analysis and generation of the signalling associated through DSP Signalling control for each single channel in real time Examples of performable exercises: With the line from analogue private phone it is possible to study: <ul style="list-style-type: none"> - The conversion from four to two wires - The call current - The hook circuit - The tone selection - The multi-frequency selection - The over voice signalling With the line from analogue telephone exchange system it is possible to study: <ul style="list-style-type: none"> - The decoding of the state of the line 	10		
EL/CSL-05	Analog & Digital Communication Oscillator /Second order LPF & HPF AM Modulator/ Demodulator DSB Sc&SSC Modulator / Demodulat FM Modulator/ Demodulator PLL Frequency Synthesizer Power supply and audio generator A/D & D/A Converter Application PWM Modulator / Demodulator FSK Modulator/Demodulator CVSD Modulator/Demodulator ASK Modulator/Demodulator PSK /QSK Modulator PSK/QSK Demodulator	10		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/CSL-06	Microwave Tech Training Curriculum Outline: 1. Design and implementation of microwave front end receiver module. 2. Design and implementation of microwave front end transmitter module. 3. Design and implementation of voltage controlled oscillator and phase locked loop. 4. Design and implementation of IQ modulator and demodulator. 5. Design and implementation of digital wireless transceiver module	10		
EL/CSL-07	Antenna Trainer Antenna Training System with over 35 Antennas PLL transmitter and receiver 0.005-2 GHz. 50 KHz step size with measurement in 0.1 dB resolution 110 dB dynamic range. Directional Coupler for VSWR/ Return Loss. Stepper motor antenna rotator. 1 degree resolution stepper motor RS232 interface with polar/cartesian plotting software Microstrip antennas All SMA connectors, Teflon Cables All antenna gain, return loss and pattern plot provided 1000 location Frequency and level storage in receiver	10		
EL/CSL-08	Cellular Telephone system Antenna Training System with over 35 Antennas PLL transmitter and receiver 0.005-2 GHz. 50 KHz step size with measurement in 0.1 dB resolution 110 dB dynamic range. Directional Coupler for VSWR/ Return Loss. Stepper motor antenna rotator. 1 degree resolution stepper motor RS232 interface with polar/cartesian plotting software Microstrip antennas All SMA connectors, Teflon Cables All antenna gain, return loss and pattern plot provided 1000 location Frequency and level storage in receiver	10		
EL/CSL-09	LAN/WAN Trainer The Internet has permeated among our daily life in every aspect, and it provides the fundamental connection with many state-of-the-art technology such as third-generation cell phones, video communication and information appliances.	1		
EL/CSL-10	AM/FM Radio AM receiver frequency range : 535KHz ~ 1605KHz With perfect FM transmitter which is able to produce 10.7MHz Intermediate frequency. FM receiver frequency range : 88MHz~108MHz	10		
EL/CSL-11	Radar Trainer	1		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/CSL-12	<p>Optical Fibre and Digital Communication Trainer</p> <p>The trainer must enable teaching the principles of digital data transmission through to fibre-optics. The Trainer must facilitate demonstration, training & experimentation in basic and advanced concepts including principles of fibre-optic communications, basics of digital baseband communications, advanced experimentation and development in fibre optic & digital communications.</p> <p>Must touch following areas:</p> <p>Principles of fibre-optic communications - 850 nm and 650 nm fibre links must Demonstrate established digital communication techniques such as Time Division Multiplexing, Transmitter & Receiver operation, PCM voice coding at (64 Kbps), Manchester Coding and Decoding for timing recovery. Channels switchable at transmitter & receiver using time-switching principles. Must be easy to interface with external circuitry - all required inputs and outputs must be provided and mustbe extensively documented.</p> <ul style="list-style-type: none"> • Fibre optic analogue links • Digital link Losses in optical fibre • Effect of EMI interference • Numerical aperture measuremen • Time Division Multiplexing • Framing in Time Division Multiplex • Manchester Coding/Decoding – timing recovery • Voice coding - A-law • Pulse broadening in Fibre Optic Communications 	5		
EL/CSL-13	<p>Fiber Optics Trainer</p> <p>The Fibre-Optics Educator must have a Transmitter, a Receiver, two lengths of fibre-optic cable and various electrical connectors and accessories. Must touch following area of knowledge:</p> <ul style="list-style-type: none"> • Properties of Light • Infra-red radiation • Fibre-Optic technology • Opto-electronic devices • Fibre-Optic Attenuation • Analogue transmission methods • Digital transmission methods 	10		
EL/CSL-14	<p>Fibre-Optics Power Meter</p> <p>The Fibre-Optics Power Meter mut be accurate, versatile, low-cost unit for measuring optical power levels at terminated optical cables. With an easy to read pointer scale readings in both dBm and μW. The meter must have a broad measurement range of 1 mW (0 dBm) down to a sensitivity of better than 1nW (-60dBm). The meter must be calibrated at a wavelength of 820 nm, and permits accurate measurements between 800 nm and 850 nm.</p>	5		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/CSL-15	<p>Fibre-Optics Monitor</p> <p>The Fibre-Optics Monitor must be designed for fibre-optics and general optics measurement applications. A high radiance led in the transmitter must ensures a good measurement performance for all types of multimode optical-fibres.</p> <p>The Monitor must consists of the following items:</p> <p>1. An Optical Transmitter</p> <p>Must contains a high radiance infra-red led in the connector receptacle, un-housed infra-red LED, variable output control; variable frequency square wave generator; both digital and analogue inputs.</p> <p>Power is from an internal power source.</p> <p>2. Optical Receiver</p> <p>Must contain a loudspeaker with analogue output, low impedance analogue output and variable analogue gain; mean power monitor output: must have a silicon p-i-n diode mounted in connector receptacle.</p>	5		
EL/CSL-16	<p>Fibre-Optics Monitor</p> <p>Transmitter/Receiver combination</p> <p>Attenuation measurement range</p> <p>Standard method: 30 dB (± 0.2dB accuracy).</p> <p>High loss method: 45 dB (± 0.5dB accuracy).</p> <p>Temperature dependence of above accuracy figures: 0.01 dB$^{\circ}$C typical.</p> <p>Analogue Bandwidth: 25Hz to 20kHz (3dB points).</p> <p>Range for analogue transmission (better than 40dB SNR): 25 dB (this range is for a fibre link, with high radiance LED being used to launch light into graded index fibre, core diameter 50μm, N.A. 0.21).</p>	5		
EL/CSL-17	<p>Modulation and Coding Workboard.</p> <p>fully-featured, complete, laboratory course covering the principles of operation and the practical implementation of modern modulation systems required for both analogue and digital communication systems.</p> <ul style="list-style-type: none"> • Signals in the time and frequency domains • Sampling and Time Division Multiplexing (TDM) • Amplitude Modulation (AM) & AM with Suppressed Carrier • SSB generation with an IQ modulator • Amplitude Shift Keying (ASK) • Frequency Modulation (FM) & FM with an IQ modulator • Frequency Shift Keying (FSK) • Phase Modulation (PM) • Phase Shift Keying (PSK) • Multi-state Phase Shift Keying • Quadrature Amplitude Modulation (QAM) • Uncoded binary data formats • Bi-phase data format • Alternate mark inversion 	10		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/CSL-18	<p>Transmission Line Demonstrator</p> <p>Must provides an ideal demonstration of line characteristics and wave motion., by using a simulated line, the Demonstrator must effectively displays at low frequencies the high frequency characteristics of a transmission line so that students can easily observe them. The operator can also readily adjust them. The line must be completely symmetrical so that either end may be regarded as the input or output.</p> <p>Must come with all required accessories i.e signal generator etc.</p>	10		
EL/CSL-19	<p>Spectrum Analyzer</p> <p>Frequency Range: 9kHz ~ 3GHz High Frequency Stability: 0.025ppm 3dB RBW: 1Hz ~ 1MHz 6dB EMI Filter: 200Hz, 9kHz, 120kHz, 1MHz Phase Noise: -88dBc/Hz @ 1GHz, 10kHz Offset Built-in Measurement Functions: 2FSK Analysis, AM/FM/ASK/FSK Demodulation & Analysis, EMC Pre-test, P1dB point, Harmonic, Channel Power, N-dB bandwidth, OCBW, ACPR, SEM, TOI, CNR, CTB, CSO, Noise Marker, Frequency Counter, Time Domain Power, Gated Sweep Built-in Spectrogram and Topographic Display Modes 886MHz IF Output for User's Extended Applications Remote Control Interface: LAN, USB, RS-232, GPIB (Optional) Built-in Preamplifier, 50dB Attenuator, and Sequence Function Optional 6GHz Power Sensor, Tracking Generator</p>	1		
EL/CSL-20	<p>TELEPHONE SYSTEMS TRAINER</p> <p>Must enable for students to study following points</p> <ol style="list-style-type: none"> 1.- To study the main actions and signals involved in a digital commutation. 2.- To study the dynamic channel assignment and temporal switching. 3.- To study the standards for audio conversion. 4.- To establish of a communication between some channels step by step. 5.- Visual monitoring of the main states that a line goes through during a call. 6.- To configure lines as only receiver, transmitter, receiver / transmitter. 7.- To test of the conversion from 2 to 4 wires. 8.- To study the electric stages when the user makes actions over the telephone. 9.- To study the signals involved when dialing by pulses. 10.- To study the signals involved when dialing by tones. 11.- To study the tone signal. 	10		
EL/CSL-21	<p>Network Analyzer</p> <p>Frequency options: From 9 kHz – 4.5 GHz/6.5 GHz/8.5 GHz, 100 kHz – 4.5 GHz/6.5 GHz/8.5 GHz (with bias tees), 300 kHz – 14 GHz/20 GHz (with bias tees) Wide dynamic range: > 123 dB dynamic range at test port (typical) Fast measurement speed: 41 ms @ full 2-port cal, 1601 points Low trace noise: 0.004 dB rms @ 70 kHz IFBW Integrated S-parameter test set Port options: 2-port and 4-port Balanced measurements (4-port option)</p>	5		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
EL/CSL-22	<p>Signal Generator, 1 GHz or 2 GHz</p> <p>136 dBc/Hz SSB phase noise at 20 kHz offset at 1 GHz < -105 dBc nonharmonic spurious up to 1 GHz allows spurious rejection tests to be fully automated with confidence ±1.0 dB output level accuracy down to -127 dBm Internal modulation synthesizer with coverage up to 400 kHz and two-tone capability</p>	2		

V. ADVANCE COMPUTER LAB II

EL/ACL-01	<p>LabVIEW Department License for Software Engineering Bundle</p> <p>The Academic Site License for educators is designed for classrooms and educational labs and provides department-wide access to software for teaching. Purchase one of the options if you need five or more copies of software for teaching.</p>	1		
EL/ACL-02	<p>MG Software</p> <p>IC DESIGN SOFTWARE TOOL</p>	1		
EL/ACL-03	<p>CAD/CAM software</p>	1		
EL/ACL-04	<p>PCB Prototype machine</p>	1		
EL/ADL-05	<p>NI Vision Based Artificial Intelligence System</p> <p>It is a compact and rugged machine vision system that withstands the harsh environments common in vision-guided robotics, industrial inspection, and OEM vision applications.</p> <p>Real-Time Compact Vision System for USB3 Vision Cameras</p> <ul style="list-style-type: none"> · 1.91 GHz Intel Atom quad core processor · Fanless vision system with rugged, industrial design · Reliable NI Linux Real-Time OS · Dual USB3 Vision ports with dedicated bandwidth per port · FPGA-based isolated and TTL digital I/O · USB, serial, Ethernet, and VGA ports <p>Basler ace, acA640-120um, 659 x 494, 120 fps, Mono, 1/4" Camera Computar M0814-MP lens</p> <p>Basler ace, acA3800-14uc, 3840 x 2748, 14 fps, Color, 1/2.3" Camera Computar M0814-MP lens</p> <p>Some of the concepts covered are</p> <ul style="list-style-type: none"> · Particle Analysis · Particle Analysis Report · Particle Orientation 	2		

Item Code	Description of Equipment	Qty	Unit Price	Total Cost
	<ul style="list-style-type: none"> · Pattern Matching · Perspective Calibration · Classification Example · Color Distance Example · Color Learn Example for Color Matching Operations <ul style="list-style-type: none"> · Color Matching Example · Color Pattern Matching Example · Color Threshold Example · Compare Images Example · Edge Detection Example · Extract a ROI Example · 2D Barcode · Add Images · AVI Compressor Comparison Example · AVI Read Write With Data Example · Barcode Example · Battery Clamp Inspection Example · Blister Pack Inspection Example · Brightness, Contrast & Gamma Lookup Example · Circle Distance Example · Clamp Example 			