

OFFICE OF THE PRINCIPAL

Government Polytechnic Jashpur (C. G.) – 496 338

Village – Jhargaon, Post – Gholeng, Dist. – Jashpur (C.G.)

Email: govtpolyjashpur@gmail.com

No. GPJ/EQUIP/TENDER-3/2021-22/590

Jashpur, Date: 09.12.2021

TENDER NOTICE – 03/2021-22

Open Tender for Supply of Laboratory Equipments

Last date for Receiving sealed tender	: 18 th January 2022, 3:00 PM
Date and time of opening the tender	: 18 th January 2022, 4:00 PM
Cost of Tender	: Rs. 500.00 (Rs Five Hundred only)

Sealed Tenders are invited from are invited from manufacturers/authorized dealers of manufacturers/authorized suppliers who are willing to undertake supply and installation of items for Department of Electronics & Telecommunication Engineering (Group I) and Department of Mechanical Engineering + Science (Group II) listed in **Annexure - IV** of this OPEN TENDER. The Tender Schedules containing detailed specifications may be obtained from the office of undersigned from 17th December 2021 on any working day between 10:30 am to 5:00 pm by paying a tender fee of Rs 500/- (Rupees Five Hundred). The tender can also be downloaded from the website www.gpjashpur.ac.in or www.cgdterapur.cgstate.gov.in. If downloaded from the website tender fee of Rupees Five Hundred in form of demand draft payable to Principal, Government Polytechnic Jashpur should be enclosed at the time of submission of the tender.

Eligibility Criteria: - Firm/bidders blacklisted at any stage or by any NITs/IITs/IIITs/Central Universities/State Universities, Central/State Government institutions/body/PSUs etc. need not to apply.

(a) The bidder should be a manufacturer/authorized dealer of manufacturers/authorized engaged in respective area of works. The bidder should have sufficient Infrastructure, technical expertise and financial strength to undertake the contract.

(b) **Minimum AVERAGE ANNUAL TURNOVER** of Rs. 30 lakh in the last 3 financial years. **(Audit report/Balance sheet/CA certificate to be enclosed, duly supported by the income tax return (ITR) for financial years 2017-18, 2018-19 and 2019-20).**

(c) The bidder should have experience of supply of laboratory equipment to reputed organization/educational institutions/universities/engineering colleges/polytechnics etc. with at least 3 orders in last 03 years. The nature of completed work should be supply and satisfactory completion of project, i.e. successful installation and operation of equipments, in various Government Institutes/Reputed Firms/PSUs.

[NOTE: The documentary proof of Purchase orders in respect of works mentioned in bid MUST be submitted along with the bid.]

(d) Bidder/Tenderer should submit documents in support of minimum eligibility criteria along with the tender/bid. No document in support of minimum eligibility criteria will be accepted / entertained after opening of tender.

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Bidder is required to quote all the items of a schedule (i.e. a laboratory) failing which his bid will be considered as non responsive.

(e) The Bidder/Tenderer should provide the following mandatory information:

- i. Information on supply of laboratory equipment related work experience with at least 3 orders from reputed organizations completed successfully & satisfactorily in last 3 years. Bidder/Tenderer must submit satisfactory documentary proof from end-users.
- ii. List of Organizations/Customers dealt by them.
- iii. Last three year's copies of Income Tax Return (As mention above) & PAN number.
- iv. Copy of Registration of Firm.
- v. Copy of GST registration.

(f) Tenders/bids not meeting any of the above — Eligibility Criteria shall be rejected.

Earnest Money Deposit (EMD): - An **EMD as per the details given below** in the form of an Account Payee Bank Draft (DD) or a fixed deposit Receipt (FDR) payable in favor of **Principal, Government Polytechnic Jashpur** is required to be submitted along with the bid/tender.

Group	Group Name	Tender Amount (Rs in Lakh)	EMD (in Rupees)
I	Electronics & Telecommunication	14.00	42,000
II	Mechanical Engineering + Science	50.00	1,50,000

Performance Guarantee: - Successful Bidders must have to submit the performance security @ 10 % of the purchase order value or Contract value in the form of Fixed Deposit, Bank guarantee from a schedule commercial bank and will be retained up to the warranty Period.

Instructions for submitting the Tender:

1. Separate tenders are required to be submitted for Group I and Group II.
2. Tender will be submitted in four sealed envelope A, B, C and D as mentioned below:
 - (A) Envelope 'A' shall contain
 - I. EMD and Tender Fee (incase tender document downloaded from website).
 - (B) Envelope 'B' shall contain
 - I. Technical Bid as per Annexure-I along with all documents.
 - II. Technical Literature and Original Leaflets of equipments offered.
 - III. Authorized dealer/Manufacturer certificate for the items offered
 - IV. Undertaking of fulfillment of all condition.
 - V. Integrity Pact as per Annexure-III.

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(C) Envelope 'C' shall contain

- I. Commercial Bid for quoted Items/Equipment/Machines as per Annexure - II
- II. Discount Offer, if Any

(D) Envelope 'D' shall contain

All three afore said sealed envelope A + B + C.

Sealed envelope "D" should be super scribed as No. GPJ/EQUIP/TENDER-3/2021-22/590, Jashpur, date 09/12/2021 and Group for which tender is submitted should be mentioned. The tender should be addressed to Principal, Government Polytechnic, Jashpur, Village – Jhargaon, Post – Gholeng, Dist. - Jashpur, C.G. – 496 338.

3. The address and contact numbers for sending bids or seeking clarifications regarding this OPEN TENDER are given below –

Bids/queries to be addressed to: Principal, Government Polytechnic, Jashpur

Postal address for sending the bids: Principal, Government Polytechnic Jashpur
Village – Jhargaon, Post – Gholeng, Dist. - Jashpur,
C.G. – 496 338

E-mail ID: govtpolyjashpur@gmail.com

4. This OPEN TENDER is being issued with no financial commitment and the buyer reserves the right to change or vary any part thereof at any stage. Buyer also reserves the right to withdraw the OPEN TENDER, should it become necessary at any stage.

TERMS AND CONDITIONS:

1. Terms and conditions for supply of Items / Equipment / Machines are as following:
 - a. The tender is liable to be rejected if not submitted as per the prescribed conditions and in the prescribed format.
 - b. The bidder should quote their offer / rate in clear terms without any ambiguity.
 - c. The tender will be opened as per the date and time given above in the presence of such tenderer(s) or their representatives who are desirous to be present.
 - d. Tender received after due date and time will not be entertained.
 - e. The tender form is non transferable.
 - f. Item No. and page no. of the tender form should be strictly in chronological order. Make, name of the manufacturer with complete address should be mentioned against each item and equipment.
 - g. Printed condition on the back of the tender will not be binding unless separately mentioned. The tenderer must furnish complete and detailed specification supported by printed literature of the equipment offered.
2. All the Envelopes should be signed & sealed tape on all joints.

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- a. The rate should be FOR destination including Excise and PFFI. Nothing extra will be paid.
 - b. If rates are quoted Ex-Go down / Ex-Factory then Excise duty and PFFI charge should be clearly indicated for proper rate compatibility/ comparability.
 - c. Taxes, if liable extra, should be clearly indicated failing which the rate quoted in the tender will be considered as inclusive of all taxes.
 - d. There should be no alterations / corrections made in the Tender. The quoted rate should be in figures and words.
 - e. The tender should clearly indicate whether the equipment is complete in itself. If in the opinion of the tenderer, certain accessories are necessary with the type of the equipment tendered, the tenderer must quote for aforesaid accessories under the heading Extra but Essential.
3. Bidders are required to submit Earnest Money Deposit (EMD) as applicable, in the form of an Account Payee Bank Draft (DD) or a fixed deposit Receipt (FDR) payable in favor of **Principal, Government Polytechnic Jashpur** along with their bids. The EMD is to remain valid for a period of 90 days. EMD of the unsuccessful bidders will be returned to them at the earliest. The EMD will be forfeited if the bidder withdraws or amends impairs or derogates from the tender in any respect within the validity period of their tender.
4. The EMD will be adjusted towards the Performance Security in case of successful/selected tenders. The Performance Security will be forfeited in case of breach of agreement towards the supply of materials and installation - commissioning by the Tenderer(Supplier).The order shall stand cancelled and Performance Security shall be forfeited:
- (i) If supplier expresses his inability to execute the order for the quoted items within validity period of the tender at the rate quoted in the tender and for makes / brand quoted in the tender.
 - (ii) If the complete equipment is not supplied within the delivery period mentioned in the order or within the extended period permitted.
 - (iii) If the supplier executes only part of the order.
5. The bidder should sign an Integrity Pact agreement as per **ANNEXURE-III**.
6. Any equipment breakdown must be attended within 7 days during the valid warranty period of the equipment free of cost.
7. Payments shall be released only after the successful installation and demonstration of the machine / equipment.
8. The training for handling the machine / equipment shall be mandatorily provided by the supplier at his own cost. The tenderer may be asked to give demonstration of the equipments /software preferably at Jashpur.

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9. Extension of Delivery Period and Penalty – One time extension in the delivery period may be granted at the discretion of the undersigned. The penalty at a rate of 2% per month (of the cost of the equipment) is liable to be charged for the extension of the delivery period. In addition penalty will also be levied if equipment/item (s) is received after the delivery period or is dispatched after the delivery period mentioned in the order.
10. If defects of any kind or deviations from the specification are detected and reported to the supplier, the supplier should make replacement or rectify the defects free of cost within 30 days from the date of report, failing which the equipment will not be accepted and will be returned to the supplier at his own cost and risk, and the EMD/Performance Security will be forfeited. In case the equipment is sent for repairs to the firm, it should be repaired within 30 days, from the date of receipt of equipment failing which the same will not be accepted and EMD/Performance Security will be forfeited. However the undersigned may condone the delay in deserving cases at his discretion.
11. The undersigned reserves the right to increase/ decrease the quantity of the equipment to be supplied.
12. The submission of the tender will be deemed to be the acceptance of all the terms and conditions of the tender.
13. Tender-Rates should be valid for at least Twelve months from the date of opening of the tender. The prices should be firm without variations of any kind.
14. The undersigned reserves the right to accept the lowest or any tender and also of rejecting all or any tender without assigning any reasons for the same or to split up the tender as he may deem fit.
15. Exact and earliest possible time of delivery should be indicated in the tender against each item. The delivery period given in the order will be the date of receipt of the equipment in the institute and not the date of dispatch of the equipment by the supplier.
16. All items quoted must conform to the BIS/ISO or other certifications.
17. No advance payment shall be made.
18. The Tenderer/Bidders shall provide TIN No. and GST registration certificate having mentioned tendered item. In case of imported Machinery bill of clearance is required. If, tender received without these certificates shall be rejected without assigning any reason.
19. The Minimum Warranty / Guarantee period for the equipment supplied by the Supplier will have to be mentioned clearly which should not be less than one year from the date of installation. The tenderer will be required to undertake repair / replacement of defective parts free of cost at the institution during the warranty / guarantee period.
20. All the disputes with regard to the contract of purchase of equipment etc. are subjected to Jashpur, Chhattisgarh Jurisdiction only.

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21. In the event of the order, supplier who are the manufacturer of the equipment will be required to furnish a certificate to the effect that they are manufacturers of such and such make whereas the authorized agent or stockist will have to furnish certificate issued by the manufacturer, importer certifying that M/S is their Authorized Agent / Reseller / Retailer under the brand name. No equipment without this certificate will be accepted.
22. The Equipment / Machinery calibrated in metric system need be quoted.
23. The tenderer shall guarantee that after sales service shall be provided as and when required.
24. The supplier will render necessary assistance, if required, in the installation of the Equipment / Machinery at the institute/site free of charge.
25. No offer should be made for imported item for which import license has to be arranged by the undersigned. The entire imported item will have to be delivered in the designated institute (s) and payment will be made in Rupees.
26. The payments shall be released only after satisfactory and successful commissioning and installation of the Equipment / Machinery.
27. The rate should be quoted as per given format in Annexure-II. Packing, forwarding, freight, insurance and other incidental charges should be included in the offer price.
28. In the event of any dispute arising out of the bid or from the resultant contract, the decision of the Government Polytechnic, Jashpur shall be final.
29. The bid document /resultants contract will be interpreted under Indian laws.
30. If the successful Tenderer / Bidders, on receipt of the order, fails to execute the order within the stipulated period, in full or part, it will be open to the Government Polytechnic, Jashpur, to recover liquidated damage from the firm at the rate of 2% of the value of undelivered goods per month or part thereof, subject to a maximum of 5% of the value of undelivered goods. Alternatively, it will also be open to the Government Polytechnic, Jashpur, to arrange procurement of the required goods from any other source at the risk and expenses of the Tenderer / Bidder.
31. The undersigned is not responsible for any loss or damage to the equipments during transit irrespective of the fact that they are insured or not insured or delivery is ex-godown or factory station.
32. The Tenderer / Bidder is required to execute the agreement bond duly signed and witnessed to this office along with the letter confirming the acceptance of the order. It should be noted that in the event of failure to submit agreement bond duly filled in within the stipulated period, i.e. 10 days (Ten days), entire amount of Earnest Money / Performance Security is liable to be forfeited and order cancelled and if supply have been made in the meanwhile, they will be at the risk and responsibility of the supplier.
33. No claim shall be entertained in respect of interest on Earnest Money /Performance Security.

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34. Inspection of the equipment will be carried out at the institution after receipt of the equipments. Any request for the inspection of the same at the firm's factory / go-down / showroom etc. will not be entertained.
35. Illustrated manuals, working instructions, trainers, software and hardware, erection / wiring details of the ordered equipments must be supplied in suitable damp proof cover.

Principal

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ANNEXURE-I

PERFORMA FOR TECHNICAL – BID

Format of Application (printed on the letterhead of the Bidder/tenderer)

Sub: Supply of Laboratory Equipment - Government Polytechnic Jashpur

1. Name of the Firm :
2. Complete Postal Address :
Mb. No. : Telephone No:
Email: Fax No:
3. Details of Tender Fee:
4. Earnest Money Deposit details:
5. Are you a manufacturer/distributor/dealer/supplier? If so attach the authority letter(s) in support of your claim.
6. Year of starting of the Firm with Registration Number & Date:
7. PAN (Attach copy):
8. TIN & GST Registration No. (Attach copies):
9. Income tax return for the last three financial years and certificate for turnover (Attach copies):
10. Number of Important Engineering Institutions served as supplier of lab equipments (Attach at least one copy of the latest Purchase Order handled by your firm with copy of the Certificate of successful completion of supply on time from the institute concerned, use additional sheets if required).
11. Delivery Period in days:

DECLARATIONS:

- (i) I/We (names of partners/Proprietors) do hereby declare that the entries made in this application form are true to the best of our knowledge and believe.
- (ii) Mr..... whose Signature is given below, is an authorized representative of this firm.
- (iii) I/We also undertake the responsibility to communicate all subsequent changes in the constitution or working of firm, affecting the accuracy of the facts, stated above.

Date:

Authorized Signatory

Seal of the Firm

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Technical Bid

S.No	Name of Item along with Make	Specifications given in the Tenders	Technical Specifications which the bidder wants to supply as per Catalogue/ Brochure	Remarks

NOTE: Attach Technical Catalogue/Brochure of the product in original for above quoted Items.

**Authorized Signatory and
Seal of the Firm**

UNDERTAKING BY THE BIDDER/TENDERER

(To be signed and returned along with the tender)

I / We (Full Name,

Address.....,

have read the tender rules for the supply of various stores as per tender notice **No. GPJ/Equip/Tender-3/2021-22/590 Date 09.12.2021** of Principal, Government Polytechnic, Jashpur (C.G.) and I / We, fully accept the bidding rules / terms, & condition supplied with the bidding documents.

Date:/...../.....

**Authorized Signatory and
Seal of the Firm**

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ANNEXURE-II

PERFORMA FORCOMMERCIAL BID (printed on the letterhead of the tenderer)

The offer should be submitted in the following format only:

Sl. No.	Name of Item along with Make	Specifications given in the Tenders	Technical Specifications which the bidder wants to supply as per Catalogue/ Brochure	Price of Equipment	Cost of equipment Inclusive all	Remarks

NOTE: All the above quoted items rate should be in confirmation with the tender conditions.

**Authorized Signatory and
Seal of the Firm**

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Annexure III

PRE - CONTRACT INTEGRITY PACT

1. GENERAL

1.1 This Pre-bid contract Agreement (herein after called the Integrity Pact) is made on..... day of the month, between Government Polytechnic Jashpur, Chhattisgarh acting through Shri (Principal, Government Polytechnic Jashpur) Government of Chhattisgarh (hereinafter called the "BUYER". Which expression shall mean and include, unless the context otherwise requires, his successors in the office and assigns) and the First Party, proposes to procure **(Supply of Laboratory Equipments)** and M/s represented by Mr Designation (Here in after called the "BIDDER/TENDERER", which expression shall mean and include, unless the context otherwise requires, his successors and permitted assigns) and the Second Party, is willing to offer/has offered.

1.2 WHEREAS the BIDDER/TENDERER is a private Company / Public Company / Government Undertaking / Partnership / Registered Export Agency, constituted in accordance with the relevant law in the matter and the BUYER are a Ministry / Department of the Government, performing its function on behalf of the Government of Chhattisgarh.

2. OBJECTIVES

NOW, THEREFORE, the BUYER and the BIDDER/TENDERER agree to enter into this pre-contract agreement, hereinafter referred to as Integrity Pact, to avoid all forms of corruption by following a system that is fair, transparent and free from any influence/Prejudiced/dealings Prior to, during and subsequent to the Contract to be entered into with a view to:-

- 2.1 Enabling the BUYER to obtain the desired Stores/Equipment/work/Service at a competitive price in conformity with the defined specifications by avoiding the high cost and the distortionary impact of corruption on public procurement , and
- 2.2 Enabling BIDDER/TENDERERS to abstain from bribing or indulging in any corrupt practices in order to secure the contract by providing assurance to them that their competitors will also abstain from bribing any corrupt practices and the BUYER will commit to prevent corruption, in any form, by its official by following transparent procedures.

3. COMMITMENTD OF THE BUYER

The BUYER commits itself to the following:-

- 3.1 The BUYER undertakes that no official of the BUYER, connected directly or indirectly with the contract, will demand, take Promise for or accept, directly or through intermediaries, any bribe, consideration, gift, reward, favor or any material or Immaterial benefit or any other advantage from the BIDDER/TENDERER, either for themselves or for any person, organization or third party related to the contract in exchange for an advantage in the bidding process, bid evaluation, contracting or implementation process related to the contract.

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

3.3 All the officials of the BUYER will report the appropriate Government office any attempted or completed branches of the above commitments as well as any substantial suspicion of such a breach.

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

4. COMMITMENTS OF BIDDER/TENDERER

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

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

4.2 The BIDDER/TENDERER further undertakes that it has not given, offered or promised to give, directly or indirectly any bribe, gift, consideration, reward, favor, any material or immaterial benefit or other advantage, commission, fees, brokerage, or inducement to any official of the BUYER or otherwise in procuring the Contract or forbearing to do or having done any act in relation to the obtaining or execution of the contract or any other contract with the Government for showing or forbearing to show favor or disfavor to any person in relation to the contract or any other contract with the Government.

4.3 The BIDDER/TENDERER further confirms and declares to the BUYER that the BIDDER/TENDERER in the original Manufacture/ Integrator/Authorized government sponsored export entity of the stores and has not engaged any individual or firm of company whether Indian or foreign to inter code, facilitate or in any way to recommend to the BUYER or any of its functionaries, whether officially or unofficially to the award of the contract to the BIDDER/TENDERER, nor has any amount been paid, promised or intended to be paid to any such individual, firm or company in respect of any such intercession, facilitation or recommendation.

4.4 The BIDDER/TENDERER, either while presenting the bid or during pre-contract negotiations or before signing the contract, shall disclose any payment he has made, is committed to or

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intends to make to officials of the BUYER or their family members, agents, brokers or any other intermediaries in connection with the contract and the details of services agreed upon for such payments.

- 4.5 The BIDDER/TENDERER will not collude with other parties interested in the contract to impair the transparency, fairness and progress of the bidding process, bid evaluation, contracting and implementation of the contract.
- 4.6 The BIDDER/TENDERER will not accept any advantage in exchange for any corrupt practice, unfair means and illegal activities.
- 4.7 The BIDDER/TENDERER shall not use improperly, for purpose of competition or personal gain, or pass on to others, any information provided by the BUYER as part of the business relationship, regarding plans, technical proposal and business details, including information contained in any electronics data carrier. The BIDDER/TENDERER also undertakes to exercise due and adequate care lest any such information is divulges.
- 4.8 The BIDDER/TENDERER commits to refrain from giving any complaint directly or through any other manner without supporting it with full and verifiable facts.
- 4.9 The BIDDER/TENDERER shall not instigate or cause to instigate any third person to commit any of the acts mentioned above.

5. PREVIOUS TRANSGRESSION

- 5.1 The BIDDER/TENDERER declares that no previous transgression occurred in the last three years immediately before signing of this Integrity pact with any other company in any country in respect of any corrupt practices envisaged hereunder or with any public Sector Enterprise in India or any Government Department in India that could justify BIDDER/TENDERER's exclusion from the tender process.
- 5.2 If the BIDDER/TENDERER makes incorrect statement on this subject, BIDDER/TENDERER can be disqualified from the tender process or the contract, if already awarded, can be terminated for such reason.

6. EARNEST MONEY (SECURITY DEPOSIT)

- 6.1 Every BIDDER/TENDERER while submitting commercial bid, shall deposit an amount as specified in RFP as Earnest Money/Deposit, with the BUYER through any of the following instruments:
Bank Draft (DD) or a fixed deposit Receipt (FDR) in favor of **Principal, Government Polytechnic Jashpur.**
- 6.2 The Earnest Money/Security Deposit shall be valid up to a period of five years or the complete conclusion of the contractual obligations to the complete satisfaction of both the BIDDER/TENDERER and BUYER, including warranty period, whichever is later.
- 6.3 In the case successful BIDDER/TENDERER a clause would also be incorporated in the Article pertaining to performance Bond in the purchase Contract that the provisions of Sanctions for violation shall be applicable for forfeiture of performance Bond in case of a decision by the BUYER to forfeit the same without assigning any reason for imposing sanction for violation of the pact.
- 6.4 No interest shall be payable by the BUYER to the BIDDER/TENDERER on Earnest Money/Security Deposit for the period of its currency.

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7. SANCTIONS FOR VIOLATIONS

7.1. Any breach of the aforesaid provisions by BIDDER/TENDERER or any one employed by it or acting on its behalf (whether with or without the Knowledge or the BIDDER/TENDERER) shall entitle the BUYER to take all or any one of the following actions, wherever required: -

- (i) To immediately call off the pre contract negotiations without assigning any reason or giving any compensation to the BIDDER/TENDERER. However, the proceedings with the other BIDDER/TENDERER (s) would continue.
- (ii) To forfeit fully or partially the Earnest Money Deposit (in pre-contract stage) and/or Security Deposit/Performance Bond (after the contract is signed), as decided by the BUYER and the BUYER shall not be required to assign any reason therefore.
- (iii) To immediately cancel the contract, if already signed, without giving any compensation to the BIDDER/TENDERER.
- (iv) To recover all sums already paid by the BUYER, and in case of the Indian BIDDER/TENDERER with interest thereon at 2% higher than the prevailing Prime Lending Rate while in case of a BIDDER/TENDERER From a country other than India with Interest thereon at 2% higher than the LIBOR. IF any outstanding payment in due to the BIDDER/TENDERER from the BUYER in connection with any other contract such outstanding payment could also be utilized to recover the aforesaid sum and interest.
- (v) To in case the advance bank guarantee and performance bond, If furnished by the BIDDER/TENDERER, in order to recover the payments, already made by the BUYER, along with interest.
- (vi) To cancel all or any other contract with the BIDDER/TENDERER and the BIDDER/TENDERER shall be liable to pay compensation for any loss or damage to the BUYER resulting from such cancellation/rescission and the BUYER shall be entitled to deduct the amount so payable from the money (s) due to the BIDDER/TENDERER.
- (vii) To debar the BIDDER/TENDERER from participating in future bidding processes of the Government of Chhattisgarh for a minimum period of five years, which may be further extended at the discretion of the BUYER.
- (viii) To recover all sums paid in violation of this pact by BIDDER(s) to any middlemen or agent or broken with a view to securing the contract.
- (ix) In cases where irrevocable Letters of Credit have been received in respect of any contract signed by the BUYER with the BIDDER/TENDERER, the same shall not be opened.
- (x) If the BIDDER/TENDERER or any employee of the BIDDER/TENDERER or any person acting on behalf of the BIDDER/TENDERER, either directly, is closely related to any of the officers of the BUYER, or alternatively, if any close relative of an officer of the BUYER has financial interest/stake in the BIDDER/TENDERER's firm, the same shall be disclosed by the BIDDER/TENDERER at the time of filing of tender. Any failure to disclose the interest involved shall entitle the BUYER to rescind the contract without payment of any compensation to the BIDDER/TENDERER.

The term 'close relative' for this purpose would mean spouse whether residing with the Government servant or not, but not include a spouse separated

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From the Government servant by a decree or order of a competent court; son or daughter or step son or step daughter and wholly depended upon Government servant; but does not include a child or step child who is so longer in any way depended upon the Government servant or of whose custody the Government servant has been deprived of by or under any law; any person related, whether by blood or marriage, to the Government servant or to the Government servant's wife or husband and wholly depended upon Government servant.

- (xi) The BIDDER/TENDERER shall not lend to or borrow any money from or enter into any monetary dealings or transactions, directly or indirectly, with any employee of the BUYER, and if he does so, the BUYER shall be entitled forthwith to rescind the Contract and all other contracts with the BIDDER/TENDERER. The BIDDER/TENDERER shall be liable to pay compensation for any loss or damage to the BUYER resulting from such rescission and the BUYER shall be entitled to deduct the amount so payable from the money (s) due to the BIDDER/TENDERER.

7.2 The decision of the BUYER to the effect that a breach of the provisions of this pact has been committed by the BIDDER/TENDERER shall be final and conclusive on the BIDDER/TENDERER. However, the BIDDER/TENDERER can approach the Monitor (s) appointed for the purpose of this pact.

8. FALL CLAUSE

The BIDDER/TENDERER undertakes that if has not supplied/is not supplying similar product/systems or subsystems at a price lower than that offered in the present bid in respect of any other Department of the Government of Chhattisgarh or PSU and of it is found at any stage that similar product/systems or sub systems was supplied by the BIDDER/TENDERER to any other Department of the Government of Chhattisgarh or a PSU at a lower price, then that very price, with due allowance for elapsed time, will be applicable to the present case and the difference in the cost would be refunded by the BIDDER/TENDERER to the BUYER, if the contract has already been concluded.

9. INDEPENDENT MONITORS

9.1 This BUYER will appoint Independent Monitors (hereinafter referred to as Monitors) for this pact

9.2 The task of the Monitors shall be to review independently and objectively, whether and to what extent the parties comply with the obligations under this pact.

9.3 The Monitors shall not be subject to instructions by the representatives of the parties and perform their functions naturally and independently.

9.4 Both the parties accept that the Monitors have the right to access all the documents relating to the project/procurement, including minutes of meetings. The Monitors shall be under contractual obligation to treat the information and documents of the BIDDER/TENDERER/Subcontractor(s) with confidentiality.

9.5 As soon as the Monitor notices or has reasons to believe, a violation of this pact, he will so inform the Authority designated by the BUYER.

9.6 The Monitor will submit a written report to the designated Authority of BUYER/Secretary in the Department /within 8 to 10 weeks from the date of reference or intimation to him by the BUYER/BIDDER/TENDERER and, should the occasion arise, submit proposals for correcting problematic situations.

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10. FACILITATION OF INVESTIGATION

In case of any allegation of violation of any provisions of this pact or payment of commission, the BUYER or its agencies shall be entitled to examine all the documents including the Books of Accounts of the BIDDER/TENDERER and the BIDDER/TENDERER shall provide necessary information of the relevant documents and shall extend all possible help for the purpose of such examination.

11. LAW AND PLACE OF JURISDICTION

This Pact is subject to Indian Law, the place of performance and jurisdiction shall be the seat of the BUYER.

12. OTHER LEGAL ACTIONS

The actions stipulated in this Integrity pact are without prejudice to any other legal action that may follow in accordance with the provisions of the any other law in force relating to any civil or criminal proceedings.

13. VALIDITY

13.1 Validity of this Integrity pact shall be from the date of its signing and extend up to 2 years or the complete execution of the contract to the satisfaction of both the BUYER and the BIDDER/TENDERER whichever is later. In case BIDDER/TENDERER is unsuccessful, this Integrity pact shall expire after 03 months from the date of the signing of the contract.

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

14. The parties hereby sign this Integrity pact at on/...../.....

BUYER

BIDDER/TENDERER

Name of the Officer: - :

Designation: - Principal
.....

Department: Govt. Polytechnic Jashpur (C.G).
.....

Witness:

1) 1)

.....
.....

2) 2)

.....
.....

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Annexure IV

Technical Specifications

Group I - Department of Electronics and Telecommunication Engineering

Schedule 1 - Basic Electronics Lab

SNo.	EQUIPMENT	SPECIFICATION
1	Discrete Component Trainer Kit	<p>Complete set up for determining Characteristics of various electronic components & devices.</p> <p>In-built DC Power Supply: $\pm 5V/500mA$, $\pm 12V/250mA$.</p> <p>In-built Variable DC Power Supply: 0 to $+15V/250mA$.</p> <p>On-board AC Power Supply: 9-0-9V, $\pm 10\%$, DC Ammeter, DC Voltmeter.</p> <p>On-board ZIF Socket: 20 Pin, Breadboard</p> <p>On-board: Resistor Bank, Inductor Bank, Capacitor Bank, Variable Resistor Bank, Diode Bank, Transistors NPN (BC547) & PNP (BC557).</p> <p>On-board ICs: IC741(Op-Amp) & IC555(Timer)</p> <p>On-board: LDR, Temperature Sensor, output transformer, speaker & Relay.</p> <p>On-board: RC, RL & RLC series & parallel resonance circuits, filters (LPF, HPF, BPF and BRF).</p> <p>On-board: Clipper, Clamper, Half wave, Full wave & Bridge rectifier, Voltage Regulators.</p> <p>On-board Power Electronics Component Bank: SCR, MOSFET, IGBT, UJT, DIAC, TRIAC.</p> <p>Logic Level Inputs: Four independent logic level input switches with High / Low indicator.</p> <p>Logic Level Indicators: Eight independent buffered logic level indicators for High / Low status.</p> <p>Input Line Voltage: 230V AC $\pm 10\%$, 50Hz.</p> <p>Included Accessories: Manual, Patch cords & Mains cord.</p>
2	Linear IC Trainer Kit	<p>To study the functions of Voltage Regulator, PLL, Timer, Voltage Controlled Oscillator and Op-Amp.</p> <p>Built-in DC Power Supply: $\pm 5V$ DC/200mA, $\pm 12V$ DC/200mA.</p> <p>Built-in Variable DC Power Supply: 0 to $+15V$ DC/250mA.</p> <p>Built-in AC Power Supply: 0-9V/500mA,</p> <p>On-board Component Banks of different values as: Resistor Bank, Capacitor Bank, Inductor Bank, Variable Resistor Bank & Diode Bank.</p> <p>On-board: NPN/PNP Transistor BC547/557.</p> <p>Breadboard: 175x67x8 MM & 825 tie points.</p> <p>Logic Level Indicators: 4 independent logic level indicators for High/ Low status.</p> <p>Logic Input Switch: 4 good qualities TTL based Input Logic Switch.</p> <p>On-board Linear ICs: Phase Lock Loop IC NE-565, Fixed Voltage Regulator IC- 7805 & 7905, Variable Voltage Regulator IC-317 & 337, IC 555 Timer, Opto-coupler IC- MCT2E.</p> <p>Input Line Voltage: 230V AC $\pm 10\%$, 50Hz.</p> <p>Included Accessories: Manual, Patch cords & Mains cord.</p>

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3	Dual Trace CRO (Digital)	For comparing two or more voltage/current signals in the analysis & study of electronic circuits and systems. Bandwidth: 30MHz, Sample Rate: 200MS/s, 7 inch high resolution LCD, channel 2+1(external), Horizontal Scale(s/div): 5ns/div-100s/div, step by 1-2-5, Vertical Sensitivity: 5mV/div-10V/div(at input), Trigger Type: Edge, Pulse, Video, Slope & alternate, Trigger Mode: Auto, Normal & Single, Rise Time (at input)≤ 11ns, Max Input voltage: 400V(DC+AC peak), DC Gain accuracy ±4%, Operation manual.
4	Function Generator (3MHz)	To generate & deliver standard waveforms like Sine, Square & Triangle wave. Operating Modes: Sine, Square, Triangle, DC, Free Running, internal sweep or external frequency modulation, with or without DC offset. Frequency Range: 0.3Hz to 3MHz. Output Impedance: Switchable 50Ω/600Ω. DC Offset at 50Ω: ± 2.5V or Better. Frequency Display Accuracy: Up to 3Hz: ± (1% + 3D), 3Hz to 3MHz: ± (5x10 ⁻⁵ + 1D). Frequency Counter with Auto ranging: 10Hz to 15MHz, 5 digits Auto ranging Frequency Counter. Power Supply Output: DC Power Supply 2 x 15V/1A, 5V/1A. Sine Wave Distortion: 0.3Hz to 100kHz - Max. 0.5%, 0.1MHz to 0.3MHz - Max. 1.5% & 0.3MHz to 3MHz - Max. 3%. Square Wave Rise Time: Typ. < 40ns. Digital Display For Voltage and Current: 3 digit Switchable, simultaneous display of Voltage and current. Output Voltage: 10Vpp in to 50Ω, Max. 20Vp-p (Open Circuit). Attenuation: Max. 60dB; 2 Steps: 20dB ± 0.2dB Each; Variable: 0 to 20dB. Level Flatness (Sine / Triangle): 0.3Hz – 0.3MHz: Max. 0.2dB; 0.3MHz – 3MHz: Max. 0.5dB. Modulation: Internal Sweep or External Frequency Modulation. Sweep Speed: 20ms to 4s. Power Supply: 230V ±10%, 50Hz. Operating Condition: 0 to 50°C, 95% RH. Included Accessories: Manual, Patch cords & Mains cord.
5	Copper Clad Laminate Panel	To fabricate electronic circuit board and provide mechanical support to the electronic components. Thermal Conductivity 1.0-2.0 W/m.k, Material FR4 Epoxy Fiber, Thickness 0.05 mm - 4.0 mm.
6	Feedback Amplifier Trainer Kit	Complete set up for studying functions of all 4 topologies of feedback amplifier. In Built Supply: DC Power +12V @200mA, Feedback Amplifier on Panel (Voltage Shunt, Current Shunt, Voltage Series and Current Series), Inter connection: Using 2mm Banana sockets Power ON switch with indicator and fuse for protection, Input Line Voltage: 230V AC ±10%, 50Hz, Required numbers of patch cords and operating manual.
7	Phase Locked Loop Trainer Kit	Complete set up for studying the operation of PLL, Having built in fixed power supplies of +5V,-5V, 565 IC , 741 IC and 7490 IC divided by 10 counter is given on board, different values of resistors and capacitors with one 10KΩ potentiometer to vary the output frequencies.

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8	Analog to Digital Converter (Counter Type)	Complete set up for the verification of 8-Bit Analog to Digital Conversion with Different Methods- Monolithic ADC using IC, Flash type Comparator ADC, Counter / Ramp type ADC, Power Supplies: Analog DC Power Supply 0-15V, 150mA, Operated on Mains power 230V, 50Hz +10%, Digital Voltmeter 2V/20V DC, Independent buffered logic level indicators for High / Low status, ADC 0804 IC given on board with block diagram, Ramp type Converter using different IC's given on board.
9	Digital to Analog Converter (R-2R Ladder)	Complete set up for the conversion of digital to analog signals, Fixed DC Power Supply Source: +5V@250mA. (Built-in) Signal Source: DC Supply with toggle switches. O/P Indication: On DMM or Oscilloscope. (Optional) Interconnections: Interconnections are done using 2mm banana sockets. Logic Input Switches 8 independent Logic Input Switch with bicolor LED indication to Provide High/Low Status. Electrical/Mechanical Specifications: Power ON switch with indicator and fuse for protection. Input Line Voltage: 230V AC \pm 10%, 50Hz. Included Accessories: Power Cable, User Manual Patch Cords.

Schedule 2 - Network Analysis Lab

1	Maximum Power Transfer Theorem Trainer Kit	Complete set up to verify Maximum Power Transfer Theorem. Onboard DC Power Supply: +5V/+9V/+12V, Onboard Digital Voltmeter: 0-20V, Onboard Digital Ammeter: 0-200mA, Onboard Potentiometer: 2Nos. Power ON switch with indicator and fuse for protection, Input Line Voltage: 230V AC \pm 10%, 50Hz, Variable power supply 12 V@ 500mA, On panel circuit diagram, On panel digital voltmeter and ammeter, Required numbers of patch cords and operating manual.
2	Kirchhoff's Law Trainer Kit	Complete set up to verify Kirchhoff's Laws. Variable DC Power Supply: 0 to +12V, Adequate number of components to perform the experiments, Fuse: 500mA, slow blow, Variable Resistance: 2nos, DC Ammeter: Range up to 2A, DC Voltmeter: Range up to 20V, Input Line Voltage: 230V AC, \pm 10% 50 Hz. Required numbers of patch cords and operating manual.
3	R-L-C Series and parallel Resonance Trainer Kit	Complete set up for studying the characteristics of R-L-C Series and parallel Resonance circuits. Inbuilt + 5V /200mA Fixed DC Power Supply, Inbuilt Digital Frequency Counter range: 10Hz-2KHz (approx.), Inbuilt Function Generator with mode selection of Range 100Hz-1.7KHz, Inbuilt Resistors (3nos.), Inbuilt Inductors (3nos.), Inbuilt Capacitors (3nos.), Power ON/OFF switch with fuse protection, Input Line Voltage :230V AC \pm 10% , 50Hz, Digital Frequency Counter with Auto Range Selection, Inbuilt Function (Sine wave) Generator with Variable Frequency and Amplitude, On board Resistors, capacitors & inductors, Input Line Voltage - 230V AC \pm 10%, 50Hz. Required numbers of patch cords and operating manual.
4	Ohms Law Trainer Kit	Complete set up to verify Ohm's Law, Variable DC Power Supply : 0 to +12VDC/200mA, On board Voltmeter : 0 to 20V, On board Ammeter : 0 to 200mA, On board Potentiometer : 2 Nos. On board Fixed Resistor : 1 No, Adequate Number of 2mm banana sockets, Dual Fuse Protection

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		with Power On Switch, Input Line Voltage : 230V AC \pm 10%, 50Hz, Required numbers of patch cords and operating manual.
5	Thevenin's and Norton's Theorem Trainer kit	Complete set up for determining voltage or current in a circuit using Thevenin's and Norton's Theorem, Variable power supply 12V@500mA, On panel resistor network with load resistor, Required numbers of patch cords and operating manual.
6	Superposition Theorem Trainer kit	Complete set up for determining voltage or current in the branch of any circuit using Superposition Theorem, Onboard Variable DC Power Supply: 0 to +12VDC (2nos), Onboard Digital Voltmeter: 0-20V, Onboard Digital Ammeter: 0-2A, Onboard Potentiometer: 1Nos, Power ON switch with indicator and fuse for protection, Input Line Voltage: 230V AC \pm 10%, 50Hz, Required numbers of patch cords and operating manual.
7	DC power supply	To provide required DC power supply to various electronic trainer kits, DC Output: 0 to 30V/ 2A, 0 to \pm 15V/ 1A Tracking, 4.5 to 5.5V/ 5A, Setting Resolution: Voltage - 10mV, Current - 5mA, Mode of Operation: Constant Voltage, Constant Current, Load Regulation: $\leq \pm$ (0.05% + 10mV), Line Regulation: $\leq \pm$ (0.05% + 10mV), Ripple & Noise: \leq 1mVrms, Recovery time: \leq 50 μ s, Current Limit adjustment: 100mA to max, Display: Switchable 3 digit seven segment LED for Voltage and Current, Display Accuracy: V: \pm (1% + 1D), I: \pm (1% + 3D), Protection: Over load and Short circuit protection, over heat and over voltage protections, Input Supply: 230 VAC \pm 10%, 50Hz, Operating condition: 0 - 40°C, RH 95%. All output should be floating and suitable for front panel, built in over heat protection.
8	Two Port Network Trainer	Complete set up to study the characteristics of two port network circuits, On Board Circuits: T Network, Network & Hybrid Network available on the Trainer On board Digital Meters: On Board Digital Display meter Digital Voltmeter (Dual Range): 0-20V and 0-200VDC Digital Ammeter (Dual Range): 0-200mA and 0-2Amp. On board DC Power Supply : Provided Dual Isolated DC supply with Short circuit Protection Variable DC Power Supply: 0- 15Volt (2nos) On board Potentiometer: 2nos On Board LED Indicator: 2nos Input Line Voltage: 230V AC \pm 10% , 50Hz Accessories: Power Cord, Operating Manual, Patch cords.
9	Active Filter Trainer Kit	Complete set up for the analysis of Active Filter Circuits, On Board Function Generator- Output Waveform-Sine Frequency and Amplitude Adjustment is provided using Potentiometers One LED indicator to indicate Power Input, On-board Circuits a. Inverting Low Pass Filter b. High Pass Filter c. Non-Inverting Low Pass Filter d. Unity Gain Phase Shift Supply Connections to OP- Amp(\pm 12V) Internally provided to the circuit .

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10	Passive Filter Trainer Kit	Complete set up for the analysis of Passive Filter Circuits, Demonstrating the principle & working of various passive filters, study the attenuation & phase characteristics of each filter circuit. The Various Passive Filter Circuits covered are as follows :1. Constant K type low pass filter. 2. Constant K type high pass filter. 3. Constant K type band pass filter. 4. Constant K type band reject filter. 5. Constant M type low pass filter. 6. Constant M type high pass filter. 7. Constant M type band pass filter. 8. Constant M type band reject filter. No Power Supply Is Required Since Only Passive Components Are Used.
11	Rheostats	To provide different values of resistance to the various circuits for performing practical:- 0-50 Ohms,5A:- 02 Nos. 0-100 Ohms,5A:- 03 Nos. 0-300 Ohms, 2A:- 02 Nos.

Schedule 3 - Measurement and Instrumentation Lab

1	Wheatstone Bridge Trainer Kit	Complete set up to measure an unknown electrical resistance of a resistor using Wheatstone Bridge, On-board Fixed Power Supply: +5V DC. Null Point Adjustment: Variable resistor for null point adjustment. Unknown Resistors: On-board different value unknown resistors, On-board Band switch for Resistor selection with Coarse & Fine tuning. Measuring range: 1Ω-10 MΩ, Accuracy: ±0.1% of reading on 100Ω to 100kΩ Range, ±0.3% of reading on 10Ω to 1MΩ Range, ±0.6% of reading on 1Ω to 10MΩ Range. Temperature coefficient of resistance element: ±0.5 x 10 ⁻⁵ /°C at ambient temperature of 5 to 35°C (41 to 95°F), ±2 x 10 ⁻⁵ /°C at ambient temperature of 20 to 35°C (68 to 95°F). On-board: Micro Ammeter, Power ON switch with indicator and fuse for protection. Interconnections: 16Nos. (using 2mm banana sockets). Input Line Voltage: 230V AC ±10%, 50Hz Standard Accessories: Head Phone 1no, User Manual 1no, Patch Cord 10nos, Power Cable 1no Operation manual.
2	Kelvin Double Bridge Trainer Kit	For the measurement of low resistance It should have following :- <ol style="list-style-type: none"> 1. Slide wire with silver contact 2. Terminal head provided to set the bridge at true zero 3. Zero readings should be attained for null point 4. Should be with self-lubricating arrangement slide wire 5. Should have inbuilt current reversing switch 6. Should have variable standard resistance in 10 steps of 0.01 ohm and one slide wire of 0.01 ohm divided into 500 equal parts 7. Should have the multiplying ratio of 0.01, 0.1, 1, 10 & 100 8. Range should be between 0.2 micro ohm to 100 ohms 9. Current upto 5 A continuous and from 5 – 10 intermittently

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		<p>10. Accuracy should be $\pm 0.05\%$ or ± 1 slide wire division</p> <p>11. Should be supplied with 10 A, 15V DC power supply</p> <p>12. Should have conductivity attachment with heavy terminals for wire holding. The length must be 50CM, should have separate current & potential arrangements, made of teak wood</p> <p>13. Should have current reversing switch</p> <p>14. Should be supplied with electronic null detector having sensitivity of 5×10^{-6} Volts per sec, having variable resistance for sensitivity reduction</p> <p>Should work at 230V, 50Hz, Operation manual</p>
3	Maxwell Bridge Trainer Kit	Complete set up to measure inductance value of the given inductor using Maxwell Bridge, On-board Fixed Power Supply: +5V DC, On-board Sine Wave Oscillator, Frequency: 1KHz, 2KHz and 5KHz Switch Selectable, Amplitude: Adjustable, Null Point Adjustment: Variable resistor for null point adjustment, Unknown Inductor: On-board different value of unknown inductor, On-board Band switch for Resistor selection with Coarse Adjustment and Fine tuning, On-board Band switch for Capacitor selection, Interconnections: 13Nos. (using 2mm banana sockets), Power ON switch with indicator and fuse for protection, Input Line Voltage: 230V AC $\pm 10\%$, 50Hz, Standard Accessories: Head Phone, User Manual, Patch Cords, Power Cable.
4	Wein Bridge Trainer Kit	Complete set up to measure capacitance value of the given capacitor using Wein Bridge, Variable power DC supply: 0-15V, On-board Sine Wave Oscillator, Frequency: 1KHz, 2KHz and 5KHz Switch Selectable, Amplitude: Adjustable, Null Point Adjustment: Variable resistor for null point adjustment, Unknown Resistors: On-board different value of unknown Resistor, On-board Band switch for Resistor selection with Coarse & Fine tuning, On-board Band switch for capacitor selection, Interconnections: Using 2mm banana sockets, Power ON switch with indicator and fuse for protection, Input Line Voltage :230V AC $\pm 10\%$, 50Hz, Standard Accessories: Head Phone, User Manual, Patch Cord, Power Cable.
5	LVDT Trainer	Complete set up to measure displacement with the help of LVDT transducer, Parameter Measured: Linear Displacement. Measurement Range: 10mm (± 5 mm), Type: Axial Type, Circuit: AC Excitation Source, Buffer Amplifier Differential Amplifier, Rectifier & Filter, Digital Display, Excitation Source:- Frequency : 4KHz, Variable Amplitude : 0–10V (P–P), Display: Displacement (mm), 3.5 digit seven Segment display with polarity indicator, Power ON switches with indicator and fuse for protection. On Board Potentiometer Bank Output Display: 3 and $\frac{1}{2}$ Digits Digital Panel Meter calibrated in $^{\circ}$ C, Input Line Voltage: 230V AC $\pm 10\%$, 50Hz, Standard Accessories: Head Phone, User Manual, Patch Cord, Power Cable.
6	Strain Gauge Trainer Kit	Complete set up to measure the weight of the given sample using Strain Gauge Bridge, Microcontroller based trainer system, Strain Gauge (350 Ω): 2 Nos., Gauge Factor: 2.11, $\pm 1\%$, Maximum Weight Capacities: 1.5kg, Cantilever Material: Stainless Steel, Bridge Voltage: +5 V DC,

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		Display: 3½ Digits LED
7	Load cell trainer kit (pressure measurement)	Complete set up to test the performance of the given load cell, ± 12V D.C. at 100 mA I.C. regulated Power Supply, 5V D.C. at 100 mA IC regulated Power Supply, IC for comparison of Load Signal, Load Cell of 3kg with 200mV output, DPM of 3½ digit display for 3kg, Operations manual.

Schedule 4 - Communication, Audio and TV Lab

1	PA (Public Address) System	Complete set up to establish and install PA system, Signal to noise ratio: 60dB, Frequency response: 100 Hz to 15KHz. Amplifier with two mic. Inputs. One mic. & One Aux. Inputs. Power supply: 220VAC 50 Hz. Power Output: 80 Watt RMS Max. Tone control: Bass, Treble. Audio Monitoring Indicators. Output Tap for speaker matching: 4, 8 & 16 Ω.
2	AM Trainer kit	Complete set up to study the amplitude modulation of various signals, Message Signal : Sine wave Frequency 100 Hz to 2.8 KHz, Amplitude 0 to 3Vcarrier, Signal : Sine wave Frequency 28 KHz to 108KHz, Amplitude 2V Modulation : Balanced Modulator, Amplifier : Op Amp Based, Demodulation : Diode Detector & LPF, Low Pass Filter : 6th Order LPF, supply Voltage (Board) : +12V, +5V DC, Supply current : 100 mA (Minimum) , Input Voltage : 230 V/ 50 Hz AC, Operation manual.
3	FM Trainer kit	Complete set up to study the frequency modulation of various signals, Message Signal : Sine wave Frequency 100 Hz to 2.8 KHz, Amplitude 0 to 3V, Carrier Signal : Sine wave Frequency 100 KHz, Amplitude 5V Modulation : XR 2206 Based, Demodulation : PLL Detector & LPF, Low Pass Filter : 4th Order LPF, Supply Voltage (Board) : +12V, +5V / DC, Supply current : 100 mA (Minimum), Input Voltage : 230 V/ 50 Hz AC, Interface connectors : 2mm socket, Operation manual.
4	PAM/PPM/PWM Modulation & demodulation trainer kit	Complete set up to test the performance of PAM/PPM/PWM modulator & demodulator circuits, Message Signal 1: Frequency 500 Hz, Amplitude 0 to 5V, Message Signal 2: Frequency 1 KHz, Amplitude 0 to 5V, Message Signal 3: Frequency 2KHz, Amplitude 0 to 5V, Carrier Signal (Square): Frequency 8KHz, 16KHz, 32KHz, 64KHz, Amplitude 5V, Carrier Signal (Triangle): Frequency 8KHz, 16KHz, 32KHz, 64KHz, Amplitude 2V, Modulator Type (PAM): 74HC4053 Based (Switching), Modulator Type (PPM): IC 555 Based (Timer), Modulator Type (PWM): LM 311 Based (Comparator), Demodulator: 4th Order LPF, Amplifier: Op-Amp Based, Supply Voltage (Board): +12V, +5V / DC, Operation manual.
5	ASK / PSK / FSK Modulation and Demodulation Kit	Complete set up to test the performance of ASK/PSK/FSK modulator & demodulator circuits, Data Simulator :Onboard 8-bit variable NRZ - L pattern, Crystal Oscillator: 32.768 MHz, Data Clock: 256 KHz, Data Format : NRZ (L), Onboard Carrier Sine Waves : 1MHz (0°), 1MHz (180°), 500KHz (0°) Carrier Modulation :ASK, FSK, PSK, Carrier Demodulation :ASK, FSK, PSK, Intermediate Signal :During demodulation, Power Supply : +12V,-12,

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		+5V, GND, Operation manual.
6	Elementary Fiber Optics Trainer Kit	Complete set up to test the long- distance & high performance data networking, Transmitter: 1 No., Fiber Optic LED having peak wavelength of emission 660 nm, Receiver: 1 Nos., Fiber Optic Photo detector, Modulation Techniques: 1. AM 2. FM 3.PWM, Drivers: 1 No. with Analog & Digital modes, Clock: Crystal Controlled Clock 4.096 MHz, PLL Detector: 1 No. AC Amplifier: 1 No., Comparator: 1 No. Filters : 1 No. 4 order Butterworth, 3.4 KHz cutoff Frequency\ Analog Band Width : 350KHz, Digital Band Width :2.5MHz, Voice Link : F.O. Voice link using microphone & speaker (built in), Switched Faults : 4 in transmitter & 4 in Receiver, Fiber Optic Cable : Connector Type Standard SMA, Cable Type : Step indexed multimode PMMA plastic cable, Core Refractive Index : 1.492, Clad Refractive Index : 1.406, Numerical Aperture : Better than 0.5, Acceptance Angle : Better than 60 deg., Fiber, Diameter : 1000 microns, Outer Diameter : 2.2 mm, Fiber Length : 0.5 m & 1 m, Test Points : 29 Inter connections : 4 mm sockets, Power Supply : 220 V \pm 10 %, 50 Hz / 60 Hz on request, Power Consumption : 3 VA (approx.), Accessories Included : Line cord, Manuals, NA Measurement, Jig, Mandrel, Fiber Cables, Microphone, Headphone, Set of Patch Cords, Optional Accessories : Optical Power Meter, 5 meter fiber cable, 10 meter fiber cable, Operation manual.
7	Phase modulation and demodulation trainer kit	Complete set up to study the phase modulation of various signals, Message Signal Sine wave Frequency 100 Hz to 2.8 KHz, Amplitude 0 to 3V, Carrier Signal: Sine wave Frequency 28 KHz to 108 KHz, Amplitude 2V, Modulation: Balanced Modulator, Amplifier: OP Amp Based, Demodulation: Diode Detector & LPF, Low Pass Filter: 6th Order LPF, Supply Voltage (Board): +12V, +5V / DC, Supply current: 100 mA (Minimum), Input Voltage: 230 V/ 50 Hz AC, Interface connectors: 2mm socket, Operation manual.
8	Digital Storage Oscilloscope Dual Channel	To store & analyze the various input signals digitally, No. of Channels: 2 , Bandwidth: 70MHz, Real time Sampling: 1GSa/s, Equivalent Sampling: 50GSa/s, Memory: 2Mpts, Vertical Resolution: 8bits, Coupling: AC, DC & Ground, Rise Time: \leq 5.0 ns, Vertical Scale: 2 mV/div to 10 mV/div, Input Impedance: $1M\Omega \pm 2\%$ 16pF \pm 3pF, Max. Input Voltage: 400V (DC+AC pk pk $1M\Omega$ i input impedance X 10), Frequency Counter: Inbuilt, 100 MHz, Time Base Range: 5ns – 50s/div, Time Base Accuracy: \pm 100 ppm measured over 1ms interval, Trigger Source: CH1, CH2, EXT, EXT/5, AC line, Trigger Mode: Auto, Normal, Single, Trigger Type: Edge, Pulse width, Video, Slope, Attenuation, Measurement Parameters: 32 Automatic measurement parameters, Math functions: Add, Subtract, Multiply, Divide & 1024 point FFT, Interface: USB Host, USB Device, RS232, LAN & PASS/FAIL Out, Display: 7.0" TFT LCD display, Save/Recall Type: Setups, Waveforms, CSV file, Picture, Standard Interface. Operation manual,

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		Patch cords & Mains cord
9	4-Channel TDM-PCM Transmitter & Receiver	Complete set up to test the performance of TDM-PCM modulator & demodulator circuits, In built IC based Deregulated power supply +12V, +5V/500mA On board sine wave generator, Frequency: 1 KHz- 2KHz Adjustable amplitude 0-10Vpp Approx, Variable DC level + 5VDC (2Nos.) On board crystal frequency: 12MHz 2-Input channels Pulse Code Modulation Technique Pseudo random sync, code generator Error check code (Off-Odd-Even-Hamming), Operating mode: Fast 240KHz/channel (Approx.) Slow 1 Hz/channel (Approx.), On board test points 49, Block diagram printed on Glass Epoxy PCB & all important test points brought out on front panel, Power requirement: 220 VAC ±10%, 50Hz, Operation manual.
10	Delta Modulation and Demodulation Trainer Kit	Complete set up to test the performance of Delta modulator & demodulator circuits, Sampling Frequency 20KHz Square wave using IC 555, Modulating Signal 250Hz Sine wave using IC TL084 with variable amplitude up to 3 Vpp, Delta Modulator Using IC 74193 & DAC 0800, Delta Demodulator Using IC TL084, Power Supply 230 V ±10%, 50/60 Hz, Operation manual.
11	DSB/SSB AM Transmitter	Complete set up to test the performance of DSB/SSB AM Transmitter circuit, Audio Oscillator with adjustable amplitude and frequency 300 Hz to 3.4 KHz, audio output: amplifier with speaker, modulators: balanced modulator, carrier frequency: 1MHz (crystal controlled), power supply: 230V, 50/60 Hz, Operation manual.
12	DSB/SSB AM Receiver	Complete set up to test the performance of DSB/SSB AM Receiver circuit, Frequency Range 980 KHz to 2060 KHz, Power Supply 230 V ±10 %, 50/60 Hz, Intermediate Frequency 455 KHz, Tuning With Variable Capacitor (ganged) Dial marking on Board, Receiving media Telescopic Antenna / Cable, Audio Output Amplifier with Speaker, Operation manual.

Schedule 5 - Digital Electronics and Microcontroller Lab

1	Digital IC Trainer kit	<p>Complete set up to test the performance of various logic gates & combinational circuits.</p> <p>On-board Fixed DC Power Supply: ±5V/250mA, ±12V/250mA</p> <p>Clock Generators:</p> <p>a) Fixed simultaneous independent TTL outputs</p> <p>1) 1Hz, ± 1%</p> <p>2) 10Hz, ± 1%</p> <p>3) 100Hz, ± 1%</p> <p>b) Variable : up to 1KHz</p> <p>On-board: DC Voltmeter, DC Ammeter.</p> <p>Manual Pulser: two independent debounce manual pulsars.</p> <p>Logic Input Switches: 10 independent logic level inputs with a LED to indicate high/low status.</p> <p>Logic Level Indicators: 10 independent logic level indicators for</p>
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		<p>High/Low status.</p> <p>On-board: 7 segment with digit indication.</p> <p>On-board Logic Probe: 2 nos.</p> <p>ZIF socket: ICs up to 20 pin can be placed.</p> <p>Breadboard: 175 x 67x8MM & 825 tie points.</p> <p>Digital ICs: Digital ICs are mounted on board are - 7400 7402 7404 7408 7420 7425 7432 7447 7476 7483 7485 7486 7490 7495 74121 74163 74193.</p> <p>Required numbers of patch cords and operating manual.</p>
2	4 bit half & full adder & subtractor Trainer kit	<p>Complete set up to test the performance of 4 bit half & full adder & subtractor circuit.</p> <p>Inbuilt DC Power Supply Source: +5V/200mA.</p> <p>Short Circuit Protection: On-board short-circuit protection for all fixed and variable DC power supplies.</p> <p>On-board Logic Level Indicator: 9 independent logic level indicators for High/Low status with Bi Color LED.</p> <p>On-board Logic Input Switches: 16independent logic level inputs to generate high/low status with Bi Color LED.</p> <p>On-board: Two AND gates (7408), one OR gate (7432), Two NOT gates (7404) & Two EX-OR gates (7486) on panel.</p> <p>Logic Levels: High (Logic 1): +5V, Low (Logic 0): 0V.</p> <p>Electrical/Mechanical Specifications: Power ON switch with indicator and fuse for protection.</p> <p>Input Line Voltage: 230V AC ± 10%, 50Hz</p> <p>Built-in power supply DC +5 V @ 500 mA, 3 Logic input switches with green LED display, 3 Logic output red LED display, Two AND gates (7408), one OR gate (7432), Two NOT gates (7404) & Two EX-OR gates (7486) on panel, Required numbers of patch cords and operating manual.</p>
3	8051 microcontroller	<p>Complete set up to study the architecture of 8051 microcontroller & perform various programming using 8051 microcontroller, 8031/51 based microcontroller training kit shall be with onboard 40x2 LCD display, RS-232 & USB Connector. Built in assembler & de-assembler. Fitted in attractive wooden box & with Cable-Connector Set& should have: High Performance 8031/51 MCU @ 12 MHz, Onboard 40x2 LCD Interface options. On board 40x2 LCD display & connector for 104 Key Standard PC compatible Keyboard, On Board USB interface hardware, 64K Onboard Program Memory, Powerful monitor software with Standard Commands like Move, Fill, Display / Modify Memory / Registers, Execute Program, Upload / Download etc, Single line Assembler & De-assembler, 12KB Battery backed up User Program Memory, Two Modes of Operation: Monitor Mode & Serial Mode. Serial mode for using the kit with terminal, Supplied in attractive wooden enclosure, Documentation includes User Manual with details, Cable & connector set available for interfacing, Switch Mode Power, Supply with +5v/3A, +12v/1A, -12v/0.5A, Compatible Keyboard, Operation manual.</p>
4	BCD to Seven Segment Decoder	<p>Complete set up for decoding BCD to seven Segment, BCD to 7-Segment Decoder,7-Segment LED Display, 4 logic input Switches, In-built Power Supply, Operation manual.</p>

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5	4- Bit Binary Universal Shift Register	Complete set up for studying the characteristics of 4-bit Binary Universal shift Register, Built-in power supply DC +5 V @ 500 mA, 3 Logic input switches with green LED display, 3 Logic output red LED display, Two AND gates (7408), one OR gate (7432), Two NOT gates (7404) & Two EX-OR gates (7486) on panel, Operation manual.
6	Flip-Flop Demonstrator	Complete set up to verify various types of Flip-Flop circuits, Built-in Fixed DC Power Supply: +5V@250mA. Built-in Manual Pulsar: 2 Nos. Built-in Logic Level Generator: 4 independent Logic level inputs with a bicolor LED to provide high/low input. Built-in Logic Level Indicator: 4 independent Logic level indicators with a bicolor LED indicator for high/low status. Test Points/Interconnections: Interconnections are done using 2mm banana sockets. Electrical/Mechanical Specifications: Power ON switches with indicator and fuse for protection. Input Line Voltage: 230V AC \pm 10%, 50Hz. <ul style="list-style-type: none"> • Study and verification of the Truth Table of R-S Flip Flop. • Study and verification of the Truth Table of J-K Flip Flop. • Study and verification of the Truth Table of D Flip Flop. • Study and verification of the Truth Table of T Flip Flop. • Study and verification of the Truth Table of J-K Master/Slave Flip Flop. Required numbers of patch cords and operating manual.

Schedule 6 - Power Electronics Lab

1	SCR Triggering Using UJT Relaxation Oscillator Trainer kit	Complete set up to test the performance of a given SCR and plot the VI characteristics, 35V A.C. at 100mA A.C. Power Supply, Bridge rectifier for making D.C. voltage, Two Silicon controlled rectifier (SCR,) Uni-Junction Transistor, Pulse transformer 1:1, Two potentiometer for varying load, Two potentiometer one for controlling The unit is operative on 230V \pm 10% at 50Hz A.C. Mains, Adequate no. of patch cords stackable 4 mm spring loaded plug length ½ meter, Operation manual.
2	Single Phase to single phase Cyclo - Converter Trainer	Complete set up to measure the input to output frequency of a single phase to single phase step up/down cyclo converter, In built triggering circuit, Two no's of potentiometers for varying the PWM frequency and duty cycle, Frequency selection switch, IC based PWM generation. Potentiometer to vary the firing angle , In built resistive load, 1:1 pulse transformer for isolated triggering of SCR, Kit working voltage :(220-240)V AC, Input voltage : 24V A.C., Operation Manual.
3	Parallel Inverter Using SCR Trainer kit	Complete set up to test the performance of a single-phase half/full bridge inverter feeding R load. Power supply: 230V AC, 50 Hz. Built in firing circuit with UJT Oscillator, DC supply for inverter (Half bridge) to converter it to AC. TYN612 - 2 Nos., 25 Watt Lamp Load, and Inverter ON/OFF Control circuit, Operation manual.

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4	AC Phase Control Using SCR TRIAC & DIAC Trainer	Complete set up to test the performance of a given DIAC & TRIAC and plot the VI characteristics, 230V \pm 10% at 50Hz A.C. Mains, Gate control of TRIAC with NPN transistor, Gate control of TRIAC with PNP transistor, Phase control with TRIAC and DIAC as pulse generator for gate trigger, Operation manual.
5	Chopper using SCR Trainer kit	Complete set up to study the performance of Chopper, Potentiometer for varying frequency, Inbuilt Power supply for Chopper Circuit and triggering pulse, Inbuilt resistive load, Detailed mimic diagrams. Kit Working voltage : (220-240)VAC, Input Voltage: 30V DC, Output Voltage: 0-30V DC, Current rating: 1A, Operation manual.
6	SCR Forced Commutated circuits	Complete set up to test the performance of a forced commutation circuits(A, B, C, D & E), 230V \pm 10% at 50Hz A.C. Mains, 30V D.C. at 150 mA Fixed Power Supply, 5V D.C. at 50mA Fixed Power Supply, 5Hz Square wave Oscillator, UJT Triggering Circuit for SCR's, Two PUSH-TO-ON switch, NPN Transistor, Inductor, Diode & LED, Capacitor Bank, Adequate no. of other Electronic Components, Operation manual.

Schedule 7 - Microwave and Antenna Lab

1	Waveguide Components	<p>Complete set up to study the characteristics Waveguide Components.</p> <p>E-plane Tee: Band - X band, Waveguide - WR-90, Flange - UG-39/U, Material- Brass, Inner Coating- Silver.</p> <p>H-Plane tee: Band- X band, Waveguide- WR-90, Flange:UG-39/U, Material :Brass, Inner Coating: Silver.</p> <p>E-Plane Bend: Band- X band, Waveguide- WR-90, Flange- UG-39/U, Material-Brass, Inner Coating- Silver, VSWR Max.- 1.25 at 10.5GHz, Return Loss- 25 7 dB at 10.5GHz.</p> <p>H-Plane Bend: Band- X band, Waveguide- WR-90, Flange- UG-39/U, Material- Brass, Inner Coating- Silver, VSWR Max.- 1.06 at 10.5GHz, Return Loss- 31 dB at 10.5GHz.</p> <p>Directional Coupler, Isolator, and Waveguide Horn – Antenna, Attenuator, Circulator.</p>
2	Microwave Test Bench (Gunn based)	<p>Microwave Test Bench are used for study of Microwave characteristics like guide wavelength, free space wavelength, cut off wavelength, frequency & Klystron characteristics.</p> <p>Gunn Power Supply, Display: 16x 2 Characters, LCD: Show-volt, Current, Modulation Frequency, Voltage Range: 0 to 10V, Current: 750mA max, Stability: 0.1% for \pm10% mains variation, Ripple: 1.0mV typical, Modulating Frequency: 800 to 1200Hz, Modulating Voltage: 0 - 10Vpp variable, Modulation Modes: Continuous Wave Internal. Modulation (Square Wave) Audio Modulation & PC Data Modulation, PC Interface : RS232 Output, Connector : BNC for Gunn Bias, TNC for Pin Bias, Mains Supply : 230V AC \pm10%, 50Hz, Digital VSWR Meter Display: LCD (16 X 2), Sensitivity: 0.1mV for 200 ohm input impedance, Noise Level: Less than 0.02V, Attenuation range: 0-60dB in 10dB steps, Input : Un-biased low and high impedance crystal biased (200ohm and 200Kohm), Display: SWR Scale, dB Scale, Modulation, Frequency, Power Bar Graph, Modes: Normal, Audio, PC-Interface, Gain Control : Adjust the reference level,</p>

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		<p>variable range 0-10dB (Approximately), Input Connector : BNC (F), Input Frequency : 1 KHz \pm 10, Power : 230 Volts AC \pm 10%, 50Hz, Analog D.R.F. Meter, Band :X band, Waveguide :WR-90, Flange :UG-39/U, Accuracy: \pm2%, Calibration Incr.: 5 MHz, Max. VSWR :1.28 At 10.5GHz, Return Loss :-18.2 At 10.5GHz, Detector Mount:- Band :X-Band, Waveguide :WR-90, Flange :UG-39/U, Detector:- IN21(any equivalent), Output Connector: BNC (F), Material :Brass, Plunger: Dumble Type, Internal Plating :Silver, Isolator:- Band: X band, Waveguide: WR-90, Flange: UG 39/U, Inner Coating :Silver, Max. VSWR: 1.15, Min. Insert. Loss :0.46dB, Min., Isolation :20dB, Return Loss :22.4dB, Gunn Oscillator:- Band :X band, Waveguide: WR-90, Flange:UG-39/U, Material: Brass, Inner Coating: Silver Bial voltage max. : 10V, Power output: 10mW, Output connector:- BNC Female, Micrometer: 25mm, Pin Modulator, Band: X band, Waveguide: WR-90, Flange: UG-39/U, Material: Brass, Inner Coating: Silver, Bias Voltage: 0-12Vpp, Output Connector: TNC (F), Fixed Short, Frequency Range : 8.2 -12.4 GHz, Material : Brass, Inner Coating : Silver, Reflection Coeff. : 0.98, Matched Termination, Band : X band, Waveguide : WR-90, Flange : UG-39/U, Material : Brass, Inner Coating : Silver, VSWR: 1.03 at 10.5GHz, Return Loss : -33dB at 10.5GHz, AV power : 2W, Type : Fixed Movable Short, Band : X band, Waveguide : WR-90, Flange : UG-39/U, Material : Brass, Inner Coating : Silver, Reflection Coeff. : 0.98, S S Tuner, Band: X band, Waveguide: WR-90, Flange : UG-39/U, Material : Brass, Inner Coating : Silver, Max. VSWR : 20:1.02, Slotted Section with Dial Guage, Band : X band, Waveguide : WR-90, Flange : UG-39/U, Residual VSWR : 1.01, Slope (dB) : \pm0.2dB Tunable Probe Band : X band, Detector : In 23, Output connector : BNC(F), Type : Tunable Variable Attenuator 20 dB, Band : X band, Waveguide : WR-90, Flange : UG-39/U, Material : Brass, Inner Coating : Silver, VSWR : 1.25 At 10.5GHz, Return Loss: -19.23dB At 10.5GHz AV, Power: 2W, Operation manual.</p>
3	Microwave Test Bench (klystron based)	<p>Microwave Test Bench are used for study of Microwave characteristics like guide wavelength, free space wavelength, cut off wavelength & frequency,</p> <p>Klystron Power Supply Beam Supply Voltage : 200 - 450 VDC, Variable Current: 50mA, Repeller Supply:- 10 V to 270 V DC Variable, Filament Supply : 6.3 VDC, Over-Load Trip Current: 50mA.</p> <p>Modulation : AM (Square) FM (Saw - tooth). Frequency Range : 500 - 2000 Hz, 50 - 150 Hz Amplitude : 0 - 110Vpp, 0- 60Vpp External: Through External Modulating Signal Digital display for: Beam voltage, Beam Current, Repeller voltage Modulation Selector : CW/AM/FM/Mic/PC/EXT Meter Selector: Beam Voltage (V)/ Current (I)/(Repeller) Rep. Connectors: 5-Pin Metal Connector, BNC for External Modulation (Optional: RS-232 for PC Interface). Power Supply: 230 VAC \pm10%, 50 Hz Digital VSWR Meter Display: LCD (16 X 2) Sensitivity: 0.1mV for 200 ohm input impedance Noise Level: Less than 0.02V Attenuation Range: 0-60dB in 10dB steps</p>

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	<p>Input: Un-biased low and high impedance crystal biased (200ohm and 200Kohm)</p> <p>Display : SWR Scale, dB Scale, Modulation Frequency, Power Bar Graph</p> <p>Modes : Normal, Audio, PC-Interface</p> <p>Gain Control : Adjust the reference level, variable range 0-10dB (Approximately)</p> <p>Input Connector : BNC (F)</p> <p>Input Frequency : 1 KHz \pm 10</p> <p>Power : 230 Volts AC \pm 10%, 50Hz, Operation Manual.</p>
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Schedule 8 - Basic Electrical Engineering Lab

1	<p>Single phase induction motor</p>	<p>Complete set up to demonstrate the working of Single phase induction motor.</p> <p>1 Ph. AC Integrated motor Voltage : 230VAC, 50Hz, Capacity : 300W/4 pole/ 1500RPM/ 10 terminals. Rotor construction : Die-cast squirrel cage Rotor, Stator construction : Two windings brought out on 4 terminals for main & auxiliary, these will be used to configure different motors split phase, CSCR, CSIR, Frame/mounting : 100 frame, chassis mounted, 19 mm shaft dia. Control panel with controls and all accessories, Operation Manual</p>																		
2	<p>DC Shunt Motor with 3-Point Starter</p> <p>Partial list of Experiments to be conducted :-</p> <ol style="list-style-type: none"> 1. Starting of DC motor using 3-point starter. 2. Determination of Torque-Speed Characteristics. 3. Reversal of speed of motor. 4. Speed control of DC motor.(Armature Voltage Control). 	<p>DC Shunt Motor</p> <p>Type: DC Motor, Shunt wound, self-excited, screen protected, horizontal foot mounted, fan cooled, provided with inter poles with DC starter face plate type,</p> <table style="width: 100%; border: none;"> <tr> <td style="padding-left: 20px;">Capacity :</td> <td style="text-align: right;">5 HP</td> </tr> <tr> <td style="padding-left: 20px;">Winding :</td> <td style="text-align: right;">Shunt wound</td> </tr> <tr> <td style="padding-left: 20px;">R.P.M. :</td> <td style="text-align: right;">1500</td> </tr> <tr> <td style="padding-left: 20px;">Armature Volts. :</td> <td style="text-align: right;">220+/- 10 %</td> </tr> <tr> <td style="padding-left: 20px;">Field voltage</td> <td style="text-align: right;">220V dc</td> </tr> <tr> <td style="padding-left: 20px;">Insulation :</td> <td style="text-align: right;">Class 'F'</td> </tr> <tr> <td style="padding-left: 20px;">Type of mounting</td> <td style="text-align: right;">B3</td> </tr> <tr> <td style="padding-left: 20px;">Degree of protection</td> <td style="text-align: right;">IP 23</td> </tr> <tr> <td style="padding-left: 20px;">Duty Rating</td> <td style="text-align: right;">Continuous (S1)</td> </tr> </table> <p>Double side shaft extension</p> <p>3-Point DC Starter for DC Shunt motor, Power ratings available : 350W / 750W / 1KW / 2 KW / 3KW/ 5KW ,Voltage Input: 220 V DC. Mains Supply : 230 V \pm10%, 50Hz Variable DC : 0 -220V, Fixed DC : 220 V Rating : 2kVA, Primary Voltage : 0-230V Secondary Voltage : 0-150V, 0-150V Voltmeter (MC) : 300V, Ammeter (MC) : 10A Auto Transformer : 270V, 10A, MCB : 10A</p> <p>Operating Manual</p>	Capacity :	5 HP	Winding :	Shunt wound	R.P.M. :	1500	Armature Volts. :	220+/- 10 %	Field voltage	220V dc	Insulation :	Class 'F'	Type of mounting	B3	Degree of protection	IP 23	Duty Rating	Continuous (S1)
Capacity :	5 HP																			
Winding :	Shunt wound																			
R.P.M. :	1500																			
Armature Volts. :	220+/- 10 %																			
Field voltage	220V dc																			
Insulation :	Class 'F'																			
Type of mounting	B3																			
Degree of protection	IP 23																			
Duty Rating	Continuous (S1)																			
3	<p>DC supply</p>	<p>To provide required DC power supply to various electronic trainer kits, 2 Point DC Starter for DC Series motors, 3Point DC Starter for DC Shunt motor, Power ratings available : 350W / 750W / 1KW / 2 KW / 3KW/ 5KW ,Voltage Input: 180V DC.</p>																		

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4	Single Phase Transformer Trainer	<p>Complete set up to demonstrate the working of Single phase transformer. Electrical control panel with 1 single phase 2KVA transformer.</p> <ul style="list-style-type: none"> • Transformer winding provided will be high quality copper wound. • Primary of transformer of 220V and secondary will be 110V. • There are 3 tapping in the secondary at 50%, 86%, 100%. • Transformer will be differently housed in a MS powder cabinet for easy carrying and other general use. • Panel consists of MS powder coated housing with back side removable. • Panel fitted with front panel of insulated Bakelite sheet 6mm thick. • It is fitted with appropriate digital voltmeter, ammeter & wattmeter to record the readings. • Short circuit protection with the help of MCB. • 4A variable ac supply is provided separately through variac for short circuit test. • Load bank is provided internally on panel with 100W electrical bulbs. • Connections through 4mm safety terminals. <p>Supplied with manual</p>
5	Digital Multimeter	<p>Used to measure electrical quantitative values on an LCD screen, DC Voltage 0.1mV ~ 1000V $\pm(0.5\% + 4\text{digit})$, AC Voltage 0.1mV ~ 750V $\pm(0.8\% + 6\text{digit})$, DC Current 0.1$\mu$A ~ 20A $\pm(1.0\% + 5\text{digit})$, AC Current 0.1$\mu$A ~ 20A $\pm(1.5\% + 5\text{digit})$, Resistance 0.1 ohm ~ 40M ohm $\pm(0.8\% + 2\text{digit})$, Capacitance 10pF ~ 200$\mu$F $\pm(3.5\%)$, 4000 Counts Large LCD Display with Auto/Manual Range, No Power-OFF under natural operation, Data Hold, Max. / Min. Value Hold, Capacitance, Frequency</p>
6	Digital LCR Meter	<p>Used to measure the Inductance, capacitance and resistance of an electronic component. Inductance 2mH-20H, Capacitance 2nF-1000μF, Resistance 200Ω-20MΩ, Diode Test, Transistor Test, Continuity Buzzer , Data Hold, Alarm, Displaying : LCD Displaying, Max. Displaying: 1999 (3 ½ Digit) Auto Polarity indication. Operation environment: (0~40) °C, RH.<80%., Sampling Rate: Approx. 3 Times/ second.</p>

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Group II - Department of Mechanical Engineering + Science

Schedule 1 - Theory of Machine Lab

SNo.	Items	Specifications
1	Working Models of:	
	(i) Cam and Follower	<p>Working model of Cams & followers suitably mounted on board consisting of:</p> <p>Cam:</p> <ol style="list-style-type: none"> 1. Eccentric type - 1 NO 2. Tangent type - 1 NO 3. Circular arc type - 1 NO <p>Follower:</p> <ol style="list-style-type: none"> 1. Flat faced type - 1 NO 2. Knife edge type - 1 NO 3. Roller type - 1 NO <p>Cam and Followers are hardened up to 45 HRC to reduce wear of surfaces.</p> <p>Weights :</p> <ol style="list-style-type: none"> 1. 500gms - 1 NO 2. 1000gms - 1 NO <p>Motor:</p> <ol style="list-style-type: none"> 1. Variable speed D.C. motor 1/4 HP 2. 0-1500 rpm with speed control unit. 3. Dial gauge of standard make. 4. Digital rpm indicator for speed measurement. <p>All parts should be made of metal/plastic/acrylic. Smooth motion between mating parts should be ensured.</p>
	(ii) Brakes	<p>Working models of different types of brakes made from original reconditioned parts showing their actual working:</p> <ol style="list-style-type: none"> i. Internal expanding shoe brake ii. Double shoe brake iii. Band brake iv. Disc brake <p>All parts should be made of metal/plastic/acrylic. Smooth motion between mating parts should be ensured.</p>
	(iii) Gear Trains	<p>Working models of different types of gear trains suitably mounted and showing their actual working:</p> <ol style="list-style-type: none"> i. Spur Gear train ii. Compound Gear Train iii. Reverted Gear Train iv. Epicyclic Gear Train v. Sun and Planet Gear Train <p>All parts should be made of metal/plastic/acrylic. Smooth motion between mating parts should be ensured.</p>
	(iv) Ackerman's steering gear mechanism	<p>Working model suitably mounted and showing the actual working. All parts should be made of metal/plastic/acrylic. Smooth motion between</p>

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		mating parts should be ensured.
	(v) Slider crank mechanism	Working model suitably mounted and showing the actual working. All parts should be made of metal/plastic/acrylic. Smooth motion between mating parts should be ensured.
	(vi) Whitworth quick return Mechanism	Working model suitably mounted and showing the actual working. All parts should be made of metal/plastic/acrylic. Smooth motion between mating parts should be ensured.
	(vii) Scotch Yoke mechanism	Working model suitably mounted and showing the actual working. All parts should be made of metal/plastic/acrylic. Smooth motion between mating parts should be ensured.
	(viii) Oldham's Coupling	Working model suitably mounted and showing the actual working. All parts should be made of metal/plastic/acrylic. Smooth motion between mating parts should be ensured.
2	Static and Dynamic Balancing Machine	For static and dynamic balancing of masses of a single rotating mass system consisting of motorized power source, balancing weights and rotating shaft. Capacity – 10 to 50 kg.
3	Various types of clutch assemblies	Suitably mounted Working and cut section models of <ol style="list-style-type: none"> 1. Single plate friction clutch 2. Centrifugal clutch All parts should be made of metal/plastic/acrylic. Smooth motion between mating parts should be ensured.
4	Governor apparatus	Fractional Horse Power Motor, having Speed : 1500 RPM Closed Type Auto Transformer, Single Phase Governor Unit : <ol style="list-style-type: none"> i. Watt Governor assembly ii. Porter Governor assembly iii. Proell Governor assembly iv. Hartnell Governor assembly 4 kg/cm , 5 kg/cm stiffness Springs Sleeve dead Weights : 0.5 Kg Sleeve displacement gauge & scale fitting
5	Rope brake dynamometer	Complete experimental setup of Rope Brake Dynamometer with all accessories and instrumentation to determine the power/torque consisting of: 1 H.P. Three phase induction motor used as a prime mover Rope Brake Dynamometer with water cooling Arrangement Set of Weights Dial type spring Balance Strong supporting stand for holding whole assembly. Control Panel : Switches, Energy meter, Digital Speed Indicator with speed sensor, etc.

Schedule 2 - Metrology Lab

<u>S.No.</u>	<u>Name of Equipment/Item</u>	<u>Specifications</u>
1	Surface Roughness Tester	For surface analysis – form, waviness, roughness, Sampling length – up to 2.5 mm Measuring Range – 0.05 to 50 micrometer Operating manual

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2	Micrometer Inside	Standard single rod type, Carbide measuring faces, Measuring Range 25 to 150 mm, Reading 0.01 mm, equipped with ratchet stop, made of hardened stainless steel, rust proof, and protective cover. Make: Mitutoyo/Tesa/Baker/Equivalent
3	Micrometer Outside	Measuring Range 0 to 25, 25 to 50 and 50 to 75 MM, Reading 0.01 MM, made of hardened stainless steel, rust proof, protective cover. Make: Mitutoyo/Tesa/Baker/Equivalent
4	Vernier Caliper	Stainless steel body, Range: 0-150mm, Reading: 0.1mm, rust proof, protective cover. Make: Mitutoyo/Tesa/Baker/Equivalent
5	Depth Guage Micrometer	Interchangeable rod, Measuring Range 0 to 150 mm, Reading 0.01 mm, made of hardened stainless steel, rust proof, and protective cover. Make: Mitutoyo/Tesa/Baker/Equivalent
6	Universal Bevel Protractor	150 MM Blade, Measuring Range 0 to 360°, Least count 1 minute , Acute angle attachment, made of hardened stainless steel, , rust proof, protective cover.
7	Vernier Height Guage	Standard vernier height gauge with adjustable main scale, Measuring Range 200 MM, Reading 0.01 mm, Carbide tipped scribe, with fine adjustment, made of hardened stainless steel. Make: Mitutoyo/Tesa/Baker/Equivalent
8	Screw Thread Micrometer	0 to 25 and 25 to 50 mm, Reading 0.01 mm, Threads to be measured 1 – 1.75 mm, fixed anvil, equipped with ratchet stop, made of hardened stainless steel. Make: Mitutoyo/Tesa/Baker/Equivalent
9	Dial Indicator with stand	Plunger type, 0 to 25 mm, Least Count 0.01mm, shock proof design, hardened stem, tungsten carbide ball anvil, with magnetic stand
10	Gear Tooth Vernier Caliper	Module 1 – 26 mm, Reading 0.02mm, made of hardened stainless steel. Make: Mitutoyo/Tesa/Baker/Equivalent
11	Plug, Snap and Ring Gauges	Set of 0-25mm, 25-50mm, 50-75mm, Made of high quality steel to prevent rusting.
12	Surface Roughness Specimens for visual inspection and comparison	consists of 30 comparison specimens, covering six commonly-used machining methods turning, milling, grinding, lapping, drilling/reaming
13	Magnifying Glass	Magnification 5-10x
14	Slip Gauge	112 pieces set, Grade 2, conforming IS standards, made of high quality steel.
15	Magnetic V-block	Size 200x150x100 mm, Magnetic, made of steel, maximum dia. of work piece 50 mm, rust proof.
16	Sine Bar	Made from high quality alloy steel. Accuracy for Flatness, Squareness & parallelism within 0.005mm. Centre distance between rollers 100 mm and within +0.005mm, Hardness - 60 + Rc & Tempered Accuracy as per IS Standard.
17	Steel Rule	Made of stainless steel, hardened, tempered, Range 300 mm, Graduation 1mm, 0.5mm.

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Schedule 3 - Refrigeration & Air conditioning Lab

S.No.	Name of Equipment/Item	Specifications
1	Sling Psychrometer	For determining DBT and WBT of ambient air, Range -10 to 50 °C, Slide rule construction to quickly convert temperature to relative humidity, Accuracy ±1%
2	Cut section model of Hermitically sealed compressor	Cut Section of Hermitically Sealed Compressor - It should be made out of full size original parts, suitably sectioned and mounted to demonstrate the working of the system. All the components should be clearly visible & labeled.
3	Different types of condensers	Suitably mounted models for demonstration of: Air cooled natural convection coil condenser 500mm x 700 mm size condenser having 6mm dia tube size Air cooled Forced convection coil condenser 200mm x 250 mm apporox size air finned condenser having 5/16" tubing Size FHP fan with suitable motor Shell and tube type Condenser
4	Different types of Expansion Device	Suitably cut section models for demonstration of: i. Capillary tube expansion ii. Thermostatic expansion For demonstration purpose.
5	Different types of Evaporators	Suitably cut section models for Demonstration Bare tube evaporator Tube size 6 mm, 3 Numbers of rows Plate type evaporator Size 250mm x 70mm x 50mm Finned evaporator 200mm x 250 mm apporox size air finned Evaporator having 5/16" tubing Size FHP fan with suitable motor
6	Vapor Compression Refrigeration Trainer Kit	Complete set up to study the construction and working of vapor compression cycle and calculating the performance parameters Consisting of: Compressor Unit : 1/3 Ton of refrigeration Hermetically sealed compressor of suitable for 134a refrigerant. Condenser Unit : Forced draft finned type copper coiled air cooled condenser with fan motor. Expansion Unit : Two Types of expansion devices: i. Thermostatic Expansion Valve ii. Constant pressure Capillary Tube Evaporator Unit : Sufficient length copper tube coil is merged in water evaporator Bath. Kilver type heater placed inside the evaporator to maintained cooled

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		<p>effect.</p> <p>Control Panel Unit :</p> <ol style="list-style-type: none"> i. Digital temperature Indicator with selector switch with set of thermocouples are mounted on various locations. ii. Cam operated On-Off switch. iii. Voltmeter provided for voltage measurement. iv. Ammeter provided for load measurement. v. Energy meter for power measurement. vi. Auto Transformer for balance of cold effect vii. 0 to 350 PSI Pressure Gauge in delivery line. viii. -30 to 0 to 150 PSI compound Gauge mounted on suction line ix. Immersion Heater for balancing the cold effect. x. HP & LP safety cutout for safety. xi. Electrically operated solenoid valve <p>The complete arrangement should be suitably mounted on strong and sturdy base preferably powder coated.</p> <p>Operations manual</p>
7	Vapor Absorption Refrigeration Trainer Kit	<p>Complete set up to study the construction and working of vapor absorption cycle and calculate the performance parameters. Consisting of</p> <p>Refrigerant : Water, Ammonia,</p> <p>Hydrogen Generator : Electrically Heated</p> <p>Condenser : Natural Convection Type</p> <p>Evaporator : Natural Convection Type</p> <p>Material of Construction M.S.</p> <p>Supply : 230 Volts, 50 Hz, 1 Ph</p> <p>Temperature Indicator : Digital Indicator At The Salient Points</p> <p>Operations Manual</p> <p>The complete arrangement should be suitably mounted on strong and sturdy base preferably powder coated.</p>
8	Model of Domestic Refrigerator	<p>Cut section model of domestic Refrigerator made out of full size original parts, suitably sectioned to demonstrate the working of the system. All the components should be clearly visible & labeled.</p>

Schedule 4 - Thermal Engineering Lab

S.No.	Name of Equipment	Specifications
1	Separating & throttling calorimeter	<p>Complete set up for measuring the dryness fraction of steam consisting of:</p> <p>Separating Calorimeter Unit :</p> <ol style="list-style-type: none"> i. Separating Calorimeter Unit consisting of a circular chamber with perforated metal basket ii. Gauge Glass fitting for condensate level measurement. iii. Insulation Jacket for avoid heat losses. iv. Pressure Gauge for measuring the steam pressure inside the calorimeter. v. Thermocouple for measuring the temperature inside the calorimeter. <p>Throttling Calorimeter Unit :</p> <ol style="list-style-type: none"> i. Free expansion throttling process unit consisting of an orifice with throttling chamber.

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		<p>ii. Pressure Gauge for measuring the steam pressure inside the calorimeter.</p> <p>iii. Thermocouple for measuring the temperature inside the calorimeter.</p> <p>Condensate Chamber Unit :</p> <p>i. A mild Steel Steam Condensate chamber with provision of cooling water circulation.</p> <p>ii. Suitable piping and fittings with valves.</p> <p>Boiler :</p> <p>i. Suitable Baby Boiler for steam generation.</p> <p>ii. Gauge Glass fitting for water level measurement inside the boiler.</p> <p>iii. Glass wool Insulation with aluminum cladding to avoid heat losses.</p> <p>iv. Pressure Gauge used for measure the steam pressure inside the boiler.</p> <p>v. Thermocouples for measuring the temperature of steam.</p> <p>Condensate measuring jar</p> <p>Control Panel :</p> <p>i. Rotary Cam Switches for boiler</p> <p>ii. Digital Temperature Indicator</p> <p>Operation manual.</p>
2	Heat pump test rig	<p>Mechanical Heat Pump Experimental Test Rig to calculate the Coefficient of Performance consisting of:</p> <p>Compressor Unit :</p> <p>1/2 Ton of refrigeration Hermetically sealed suitable for 134a refrigerant</p> <p>Condenser Unit :</p> <p>Sufficient length copper tube coil is merged in water condenser Bath. Continuous water flow required inside the condenser to maintained heating effect.</p> <p>Expansion Unit :</p> <p>Thermostatic Expansion Valve</p> <p>Evaporator Unit :</p> <p>Sufficient length copper tube coil is merged in water evaporator Bath. Kilver type heater placed inside the evaporator to maintain the cooling effect.</p> <p>Flow Measurement Unit :</p> <p>Water Rotameter used for condenser & evaporator.</p> <p>Control Panel Unit :</p> <p>i. Digital temperature Indicator with selector switch with set of thermocouples are mounted on various locations.</p> <p>ii. Cam operated On-Off switch.</p> <p>iii. Voltmeter provided for voltage measurement.</p> <p>iv. Ammeter provided for load measurement.</p> <p>v. Energy meter for power measurement.</p> <p>vi. Auto Transformer for balance of cold effect</p> <p>vii. 0 to 350 PSI Pressure Gauge in delivery line.</p> <p>viii. -30 to 0 to 150 PSI compound Gauge mounted on suction line</p> <p>ix. Immersion Heater for balancing the cold effect.</p> <p>x. HP & LP safety cutout for safety.</p> <p>Whole unit is fitted on strong and sturdy supporting stand with appropriate colour combination powder coating.</p>

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3	Single cylinder Four stroke diesel engine test rig	<p>Engine Unit: Single Cylinder Four stroke Diesel Engine developing about 3700 Watts/5 H.P. power. Self Started Engine with suitable battery.</p> <p>Dynamometer Unit : Engine is directly coupled to Electric Dynamometer and inductive load Bank.</p> <p>Exhaust Gas Calorimeter Unit : Tube in Tube Exhaust gas calorimeter to measure heat losses in exhaust gases.</p> <p>Water Cooling Unit : Cooling Water measurement by rotameter to determine heat carried away by cooling water with necessary piping & fittings.</p> <p>Air Consumption Measurement Unit : Suitable capacity C.R.C. sheet metal air tank with orifice & dual column manometer.</p> <p>Fuel Consumption Measurement Unit : 3 digit digital fuel consumption unit having 0.1 least count with fuel supply tank.</p> <p>Control Panel Unit : Digital temperature Indicator with selector switch with set of thermocouples mounted on various locations. Battery charger Operation manual</p>
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Schedule 5 - Applied Mechanics Lab

S.No.	Name of Equipment	Specifications
1	Tachometer	Contact and Non contact type for Measurement of Rotation and shaft surface speed, 5digit digital display(LCD), Contact speed range : 1 to 19999 R.P.M, Optical speed : 0.5 to 99999 R.P.M, Sensing distance: 2m to 24 m, Temperature: 0 to 60°C, Chargeable battery type, Low battery indicator, Auto power off function, Accuracy ±0.05%
2	Simple Screw Jack	Completing set up for calculating mechanical advantage, velocity ratio and efficiency, consisting of accurately machine cut screw with a pitch of 5mm, carrying a double fanged turn table of about 20 cm diameter, Fitted on a heavy cast iron base and complete with two adjustable pulley, cord hooks and weights.

Schedule 6 - Non-Conventional Sources of Energy Lab

S.No.	Name of Equipment	Specifications
1	Parabolic solar cooker	Aperture area about 1.5 m ² , Parabolic dish made of single/ multiple reflectors fixed firmly to a rigid frame. Supporting frame for the reflecting bowl made of MS rings supported by MS strips or FRP material/ thick MS wire-mesh structure. The MS structure will have epoxy/ ant-rust coating, Bowl stand of mild steel epoxy/ powder coated, with arrangement to hold cooking vessels of different sizes. Tracking mechanism Manual or automatic, ISI mark pressure cooker of suitable capacity with resistant black powder coated bottom.
2	Solar Drier	5 kg capacity, Operating temperature 50 to 70 degree centigrade, suitably

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		mounted on SS structure, black powder coated aluminum tray, top unbreakable cover, arrangement for moisture removal, and source of heat – glazed solar air heating collectors.
3	Solar lighting system	<p>Photovoltaic Unit : Solar Photovoltaic Flat Plate Collector</p> <p>Power Module Unit : 12 Volts, developing about 5 watt power.</p> <p>Electronic Circuit Unit : Electronic PCB inverter circuit.</p> <p>Battery Unit : 12 Volt, 7 VA dry cell battery.</p> <p>Loading Unit : 5 Watt compressive florescent lamp.</p> <p>Complete with mountings, hardware &cables.</p>

Schedule 7 - Fluid Mechanics Lab

S.No.	Name of Equipment	Specifications
1	Differential Manometer	Glass tube 50 mm, Complete set up for demonstration of pressure measurement, wall or stand mounted.
2	Setup for Bernoulli's Theorem	<p>Complete experimental setup for verifying Bernoulli's theorem consisting of :</p> <p>Convergent divergent transparent acrylic channel with Inlet & Outlet eddies removal tanks. Piezometer tubes mounted on the top of the flow channel.</p> <p>Sump Unit: S.S. sheet metal sump of at least 70 liters capacity with inside fiber lamination and drain plug.</p> <p>Flow Measurement Unit: S.S. sheet metal measuring tank of at least 20 liters capacity with 2" drain valve. A piezometer level gauge & scale fitting are fitted on measuring tank for discharge measurement.</p> <p>Water Circulating Unit: Arrangement for water circulation with ½ H.P. centrifugal monoblock pump.</p> <p>Control Panel consisting of power supply arrangement with Standard make accessories and instrumentation.</p> <p>The complete arrangement should be suitably mounted on strong and sturdy base preferably powder coated.</p>
3	Setup for losses due to enlargement & contraction in pipes	<p>Complete experimental setup for calculating losses due to sudden enlargement and contraction in pipes consisting of:</p> <p>Pipe Fitting Assembly Unit:</p> <ol style="list-style-type: none"> i. Losses of Energy due to Sudden Enlargement. ii. Losses of Energy due to Sudden Contraction. iii. Losses of Energy in 90° Bend. iv. Losses of Energy in Sharp Elbow <p>Sump Unit: S.S. sheet metal sump of at least 50 liters capacity with inside fiber lamination and drain plug.</p> <p>Flow Measurement Unit :</p>

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		<p>S.S. sheet metal measuring tank of at least 25 liters capacity with 2" drain valve. A piezometer level gauge & scale fitting are fitted on measuring tank for discharge measurement</p> <p>Water Circulating Unit : Arrangement for water circulation with ½ H.P. centrifugal monoblock pump.</p> <p>Head Loss Measuring Unit : Differential manometer with gauge & scale fitting. (Without Mercury)</p> <p>Control Panel consisting of power supply arrangement with Standard make accessories and instrumentation.</p> <p>The complete arrangement should be suitably mounted on strong and sturdy base preferably with powder coated.</p>
4	Venturimeter setup for measurement of discharge	<p>Complete experimental setup for measurement of discharge using consisting of:</p> <p>Venturimeter Unit : 1" size Acrylic/aluminum chrome plated venturimeter fitted on line.</p> <p>Sump Unit : S.S. sheet metal sump of at least 70 liters capacity with inside fiber lamination and drain plug.</p> <p>Flow Measurement Unit : S.S. sheet metal measuring tank of at least 35 liters capacity with 2" drain valve. A piezometer level gauge & scale are fitted on measuring tank for discharge measurement.</p> <p>Water Circulating Unit : Arrangement for water circulation with ½ H.P. centrifugal monoblock pump.</p> <p>Head Loss Measuring Unit : Differential manometer with gauge & scale fitting. (Without Mercury)</p> <p>Control Panel consisting of power supply arrangement with Standard make accessories and instrumentation.</p> <p>The complete arrangement should be suitably mounted on strong and sturdy base preferably with powder coated.</p>
5	Orificemeter setup	<p>Complete experimental setup for measurement of discharge consisting of:</p> <p>Orifice meter Unit : 1" size Orifice meter is fitted on line. It consists of an Acrylic molding or brass Orifice plate sandwiched between two M.S. flanges. Pressure tapings are provided on both sides of orifice plate.</p> <p>Sump Unit : S.S. sheet metal sump of at least 70 liters capacity with inside fiber lamination and drain plug.</p> <p>Flow Measurement Unit : S.S. sheet metal measuring tank of at least 35 liters with 2" drain valve. A piezometer level gauge & scale fitting are fitted on measuring tank for discharge measurement.</p> <p>Water Circulating Unit : Arrangement for water circulation with ½ H.P. centrifugal monoblock pump.</p> <p>Head Loss Measuring Unit : Differential manometer with gauge & scale fitting. (Without Mercury)</p>

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		Control Panel consisting of power supply arrangement with Standard make accessories and instrumentation. The complete arrangement should be suitably mounted on strong and sturdy base preferably with powder coated.
	Note: Item number 4 and 5 can be combined and supplied as a single unit.	
6	Reciprocating pump test rig	<p>Complete experimental setup for studying the performance of Reciprocating pump (calculating different efficiencies and plotting characteristics curve) consisting of:</p> <p>Reciprocating Pump Unit : Variable speed 1 HP double acting reciprocating piston pump of size 25 mm suction x 20 mm delivery to discharge 1.2 LPS flow at 40 meter head.</p> <p>Sump Unit : S.S.sheet metal sump with drain plug.</p> <p>Flow Measurement Unit : S.S. sheet metal measuring tank. A piezometer level gauge & scale fitting are fitted on measuring tank for discharge measurement.</p> <p>Prime Mover Unit : 1 HP single/Three phase A.C. motor with belt drive power transmitting arrangement. VFD for speed control. Suction & Delivery Piping and fittings are provided with Pressure gauge and vacuum gauge.</p> <p>Control Panel Unit :</p> <ol style="list-style-type: none"> i. Digital Speed Indicator with speed sensor. ii. On-Off Cam Switch. iii. Energy meter for Input power measurement. <p>The complete arrangement should be suitably mounted on strong and sturdy base preferably powder coated.</p> <p>Note: Instead of Measuring tank, water flow meter can also be provided.</p>
7	Centrifugal pump test rig	<p>Complete experimental setup for plotting the characteristics curves of Centrifugal pump consisting of:</p> <p>Centrifugal Pump Unit : Variable speed 1 HP centrifugal pump of size 25 mm suction x 25 mm delivery to discharge 1.5 LPS flow at 12 meter head.</p> <p>Sump Unit: S.S. sheet metal sump with inside fiber lamination and drain plug.</p> <p>Flow Measurement Unit : S.S. sheet metal measuring tank. A piezometer level gauge & scale fitting are fitted on measuring tank for discharge measurement.</p> <p>Prime Mover Unit : 1 HP single/Three phase motor with rigid coupling. VFD for speed control.</p> <p>Suction & Delivery Piping and fittings are provided with Pressure gauge and vacuum gauge</p> <p>Control Panel Unit :</p> <ol style="list-style-type: none"> i. Digital Speed Indicator with speed sensor. ii. On-Off Cam Switch. iii. Energy meter for Input power measurement. <p>The complete arrangement should be suitably mounted on strong and sturdy base preferably powder coated.</p> <p>Note: Instead of Measuring tank, water flow meter can also be provided.</p>

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Schedule 8 – CAD/CAM Lab

S.No.	Name of Equipment	Specifications
1	CNC Lathe Trainer	X axis travel – 80 mm, Z axis travel – 140 mm, Chuck size – 100 mm, Maximum turning dia – 30 mm, Maximum turning length – 150 mm, Spindle speed – 3000 rpm, Motor – 1 HP, Turret – 8 station, Boring bar size – 20 mm, Progressive Feed – 0-1000 mm/min, Rapid feed – 1200 mm/min, Positioning accuracy - 0.015 mm, Repeatability - \pm 0.010 mm, Fanuc or Siemens emulated control system, multi controller changing facility with simulated control panel and related software, complete with standard accessories and tooling.
2	CNC Mill Trainer	X axis travel - 225 mm, Y axis travel - 150 mm, Z axis travel - 115 mm Table size – 360 x 132 mm, T – slot 2 x10 x 50 mm, Load on table – 15 kg Spindle speed – 150-3000 rpm, Motor of suitable capacity, Automatic tool changer with 6/8 no. of stations, Progressive feed – 0-1000mm/min, Rapid feed – 1200mm/min, Positioning accuracy - 0.015 mm, Repeatability - \pm 0.010 mm, Fanuc or Siemens emulated control system, multi controller changing facility with simulated control panel and related software, complete with standard accessories and tooling.

Schedule 9 - Workshop

S.No.	Name of Equipment	Specifications
1	Molding box	Wooden and Cast Iron mold boxes of small size, 150 x 150/250 x 250 mm
2	Hand riddle	200 – 300 mm
3	Shovel	For workshop use, Long slip resistant handle, square point, made of Rust proof 14 gauge sheet
4	Rammer	Suitable for workshop use, small size, Hand, Peen, and Floor types
5	Sprue Pin	Suitable for workshop use, small size
6	Mallet	Suitable for workshop use, small size
7	Strike off bar	Suitable for workshop use, small size
8	Vent rod	SS with rust proof coating, 3 x 300 mm
9	Gate cutter	Suitable for workshop use, small size
10	Gaggers	Suitable for workshop use, small size
11	Lifters	Suitable for workshop use, small size
12	Spirit Level	Size 30 cm, Accuracy 0.5 mm, Aluminum frame
13	Split Pattern	Wooden/Metal for instructional purposes
14	Single piece pattern	
15	Abrasive disc cut off machine	Cut off wheel 14", Power 2 KW
16	Wood cutter machine	Portable, Power 2 KW

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17	Gas welding apparatus	Complete Gas welding apparatus consisting of gas welding and cutting kit with cylinder, regulator and all accessories.
18	Sheet cutting machine	Hand operated sheet cutting machine, capacity 1.5mm thick sheets.
19	Soldering iron	Soldering iron for laboratory work with flux for soldering and solder filler material
20	Surface plate	Made of Cast iron, Size 600 x 1900 mm grade 1, provided with dust cover
21	Bench grinder	Grinding wheel dia.200 mm, 0.5 HP motor, Single phase
22	Bench drilling machine	Drilling capacity 13mm, 0.5 HP motor, Single phase
23	Circular saw Machine	Diameter of saw blade 300mm, max. Depth of cut 50mm, table tilting 45°, table size- 450mm x 600mm
24	Sheet bending machine	Manual Sheet bending machine, Sheet thickness 2mm, Sheet width 8 feet
25	Pipe bending machine	Hand operated roller type pipe bending machine suitable for pipe diameter 0.5inch to 2inch.

Schedule 10 - Automobile Engineering Lab

S.No.	Name of Equipment	Specifications
1	Ignition System	Demonstration working unit made out of original used parts such as switches, ignition coil, distributors, spark plugs and battery for power source, with necessary wiring connections. By switching on the switch and by giving rotation to the distributor, sequential spark in the spark plugs can be demonstrated.
2	Automotive Electrical System	This demonstration board which should give a complete idea of the electrical system of a car. In this demonstration board the actual wiring with parts and accessories of a car should be arranged, according to the electrical circuit of a car and terminals to be provided to connect the battery. By giving connection the working of individual parts such as Self starter, Alternator, Wiper Motor, Horn, Head lights, Tail lamps, Parking lamps, Side indicators, Brake light, Distributor, Sparks of spark plugs, etc., should be demonstrated. The parts should be sectioned to show the internal constructional details.
3	Gear box – Sliding mesh	Suitably sectioned model to show the working action of sliding mesh gear box. The whole model to be mounted on a suitable painted base.
4	Working models of Clutch	Suitably sectioned working models of 1. Single Plate clutch 2. Multi plate clutch 3. Cone clutch to show the action of clutch. The whole model to be mounted on a suitable painted base.
5	Automobile Differential	Suitably sectioned working model of fully floating Differential gear box and rear wheel mechanism.

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6	Braking system	Working models of 1. Drum Brake with Mechanical working 2. Drum Brake with Hydraulic working 3. Disc Brake The models should be suitably sectioned to show the actual working of the brakes.
7	Sectioned front suspension	Macpherson strut type suspension made out of original parts, suitably sectioned to demonstrate the working and mounted on sturdy base.
8	Toolkit	Complete toolkit comprising of spanners, wrenches, screw drivers, pliers, Allen key etc.

Schedule 11 - Strength of Materials Lab

S.No.	Name of Equipment	Specifications
1	Universal Testing Machine	Capacity - 200 KN 1st Range (KN) 0-200 (0.4 count) 0-400 (0.8 count) 2nd Range (KN) 0-100 (0.2 count) 0-200 (0.4 count) 3rd Range (KN) 0-50 (0.1 count) 0-100 (0.2 count) 4th Range (KN) 0-20 (0.04 count) 0-40 (0.08 count) Frame type: Four column (screw and two road) Steel casting Body for high frame stiffness Drive mechanism: Cross head movement through screw, Precise hydraulic movement for loading Recording: roll type load elongation recorder is generating the graph. Load selection: By Knob window type dial provided for load change indication. Load measurement: Pressure transferred to the dynamometer cylinder and transfer drive to needle. Pointer moves on a large dial indicating the load Displacement: By Linear scale Type of Test: Tension, Compression, Transverse, Brinell test Accuracy: + 1% of indicated Load Transverse test Support Accessories: Roller support 150mm adjustable to conduct different size of test , Horizontal Clearance: 500mm or better Tensile Clearance: 50-700mm Compression Clearance: 0-700mm Piston Stroke: 200mm or more Max. Speed (Strain): 150mm/Min and better Round Job Max Dia: 10-40mm Flat Job Max: 0 -30mm Power: 415V, 3 phase Connected Load: 2.5HP

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		Machine should be supplied with all standard accessories Operation and maintenance manuals
2	Impact Testing Machine CHARPY and IZOD Test Apparatus:	Test Standards IS:3766-2003, IS:1598-1977, IS:1757-1999, IS:1499-2003, BS:131-Part- I, II, III, IV & BSEN-10045-1993Charpy Initial potential Energy Charpy 300 Joules and Izod 170 Joules Impact Velocity 5.3 m/s for Charpy and 3.9m/s or better Effective weight of pendulum (Kg.) 21.30 Length of pendulum (Kg) 813.5 Pendulum drop angle degree 140 Charpy and 90 Izod Minimum scale graduation (joules) 2 Accessories to test specimen of size 10 x 10 x 55 mm (for Charpy) and 10 x 10 x 75 mm (for Izod). Striking angle at tip (degree) 30 Charpy and 75 Izod or better Striking radius of curvature (mm) 02 Charpy and 0.7Izod or better Machine should be supplied with all standard accessories like Support Block, Setting Gauges, set of spanner and instruction Manual.
3	Bending Moment & Shear Force apparatus	Dimensions 158 cm X 45cm X (h)60cm (approx) Total Beam length 160 cm with flexure Width of the Beam 4-6 cm Distance of Length in Between 5cm Height of the beam 36mm No. of hanger for Weight 3 No. of spring 2
4	Principal stress strain apparatus	Cantilever flexure frame 2024-T6 high-strength aluminum alloy beam; 3x25x320 mm or similar. P-3500 strain indicator or equivalent Micrometer Calipers Scale Weights and hanger
5	Extension and compression of Springs apparatus	The apparatus should be designed to be mounted on a rigid vertical support approximately 1.5metres above floor level. It is used to test tension springs up to 200mm in length. The maximum spring diameter is 38mm, Micrometer, Calipers, Scale, Weights and hanger

Schedule 12 - Machine Drawing and Computer Aided Drafting Lab

S.No.	Name of Equipment	Specifications
1	Models and Cut sections of: 1. Flange coupling 2. Bushed bearing 3. Plummer block 4. Lathe Square tool post 5. Knuckle joint 6. Cast iron pulley	Model and cut section of each item for demonstration.

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	7. Stuffing box 8. Universal coupling 9. Foot step bearing 10. IC engine parts 11. Steam engine parts	
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Schedule 13 - Chemistry Lab

S.No.	Name of Equipment	Specifications
1	Electronic Balance	Maximum capacity:160g Minimum capacity: 0.1g Readability:0.1mg Repeatability: 0.1mg (Std. Dev) max capacity, 0.02 mg Nonlinearity: ± 0.1 mg(10g change)/ ± 0.2 mg(0-max. cap.) Sensitivity Drift: ± 2 ppm / degree C (10 degree C - 30 degree C) Stabilisation time: approx 5 sec Pan diameter: 85 mm /3.3" Documents : User manual ,calibration certificate, IQ/OQ/PQ
2	Nephelometer	Digital Nephlo-Turbidity Meter for conducting Nephlo- metric & Turbidity measurement of suspended particles in solutions. Auto-ranging from 20 -200 NTU, +/- 2% of reading plus 0.1 NTU, Accuracy : ± 1 % of F.S. NTU Range Reproducibility With in ± 3 % OF F.S. Detector Round Photo - Cell Display Digital Panel Meter 3 1/2 Digit Calibration with Formazine Standard Solution to be prepare by user as per given in Manual Power supply 230 \pm 10 % 50 Hz, 30W Accessories:- 4 pcs. Test Tube, Cell riser (810) needs to be used for 20 – 200 NTU range. Light shield Complete with all accessories and operation manual
3	Conductometer	Digital Conductivity Meter measure the specific conductivity of a solution using a conductivity cell. Conductivity Range: 0 to 200 m MHO or m S Measuring Accuracy: 1% of F.S. in all the ranges, 1 count. Display: 2 1/2 Digit Digital Panel Meter. Conductivity cell : Approx 1.0 cell constant Power Requirement : 230 volt 10 %,50 Hz Standard Accessories : Conductivity Cell, Manual, Stand Complete with all accessories and operation manual
4	Electric Oven	Laboratory Hot Air Oven. Inner S.S. outer M.S. with powder coating paints. Highly insulated between two walls by high quality glass wool. Temperature: 5 ^{0C} above ambient 250 ^{0C} with thermostatic control. Size: 18" x 18" x 18" Fan for Uniform Temperature Digital Temperature Indicator Cum Controller capacity of about 40 liters
5	Muffle Furnace	TYPE OF FURNACE

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		<p>Horizontal, Box Type, with opening in the front, Low Thermal Mass Model, Electrically operated.</p> <p>OUTER CHAMBER Fabricated from mild steel sheet sections with necessary reinforcement for mechanical rigidity. Front opening provided with a hinged door for effortless opening and closing of the chamber. The structural work will be finished in heat resistant paint.</p> <p>INNER CHAMBER Hot face chamber with supporting insulation at the bottom is lined with low density high temperature resistant bricks, so as to keep the specimen to be heated. Hot face chamber with supporting insulation on rest of the sides are lined from high duty high temperature resistant Low thermal mass Ceramic Fibre Blanket.</p> <p>TEMPERATURE CONTROL By a Micro Processor Based Programmable P.I.D. Temperature Controller</p> <p>TECHNICAL SPECIFICATIONS Working Chamber Dimensions: 150mm W x 150mm H x 300mm D. Rated Maximum Temperature: 1000°C. Temperature Control: By μP Based Programmable PID Controller. Accuracy: About 2°C. Sensor: Platinum/13% Rhodium Platinum. Operating Voltage : 230Volts, 1Phase, 50Hz, 32Amps Current Rated AC Power Point. Power Rating : 4.5KW maximum</p>
6	Bomb Calorimeter	<p>To determine the calorific value of a given sample The bomb body and lid are machined from corrosion resisting stainless steel. Capacity approx.300 ml. provided with high pressure valve and electrodes. calorimeter vessel, water jacket ,stirrer FHP motor driven are provided as per IP standard, supplied with firing unit with electronic digital thermometer, pellet press, ignition wire and pressure guage on stand with copper pipe fitting.</p> <p>complete with digital firing unit and all accessories, With digital Thermometer Measurement range up to 40,000 J/gm, with standard accessories and consumables.</p>
7	Redwood Viscometer	<p>Electrically Heated With Digital Indicator and Regulator for Viscosity tests of Petroleum Product. ConfirmING to requirement of IP 70 (Former). Two adaption of Red Wood Viscometer are available No .1 for liquids having Red Wood flow 20 seconds to 2000 seconds and No. II for liquids whose flow time exceeds 2000 seconds The Complete outfit comprises Stainless Steel bath with electrical Heating arrangement Suitable to operate at 220 Volts AC Mains with tap, Silver plated oil Cup with precision stainless steel jet, cup cover, ball valve, thermometer-clip. Stirrer and stand with leveling screws</p>

Schedule – 14 Physics Lab

S.No.	Name of Equipment	Specifications
1	Photoelectric Apparatus	Complete setup for determining the work function of photoelectric

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		materials, Including Light source, Digital voltmeter and ammeter, Vacuum photo tube, filters of different colors.
2	Diode laser	Complete set up for determining divergence of laser, including optical bench (1 m), laser source, convex lens, detector and power supply.
3	Surface Tension Apparatus (Capillary rise method)	Complete set up including Capillary tubes of different radii, Beaker, Travelling microscope with horizontal and vertical movement (least count 0.01 mm), Glass plate to fix the tubes, A needle, support base to keep the beaker, Support stands and clamps.
4	Stoke's law Apparatus	Complete set up including Glass tube of suitable length and diameter with stand, timer, steel spheres of different size, glass beads.

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