



## SCIENCE COLLEGE (AUTONOMOUS)

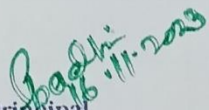
HINJILICUT-761102, GANJAM, ODISHA

### Request for Proposal (Rfp) to Select Supplier for

"Supply and installation of Laboratory Equipments/Apparatus" at the college premises

RfP No: 11342302/OHEPEE/ 2022-23/11

Dated: 16.11.2023

  
Principal  
Science College (AUTO)  
Hinjilicut (Ganjam)

### ISSUED BY:

Principal,  
Science College (Autonomous),  
Hinjilicut-761102,  
Ganjam, Odisha

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## **SECTION 1: SCHEDULE OF RfP**

Sl. No.	Particulars	Details
1	RfP No.	11342302/OHEPEE/2022-23/11
2	Date of Issue of RfP	16.11.2023
2	Name & Address of the RfP issuer	Principal Science College (Autonomous), Hinjilicut-761102, Ganjam, Odisha Contact number: 06811-280024 E-Mail: principalsch@gmail.com
4	Scope of Work	Supply of Laboratory Equipments/Apparatus at the premises of Science College (Autonomous), Hinjilicut-761102, Ganjam, Odisha
5	Method of Selection	Least Cost Selection Method
6	Deadline for Submission of Pre-Proposal Query	20.11.2023
7	Pre-Proposal Meeting	23.11.2023
8	Issue of Pre-Proposal Clarifications if any	28.11.2023
9	Last date for Submission of Proposals	07.12.2023
10	Date of Opening of Technical Proposals	08.12.2023 at 11.00 AM
11	Date of Opening of Financial Proposals	08.12.2023 at 2.00 PM
12	Earnest Money Deposit (Refundable for unsuccessful Firms)	Rs 1,60,000
13	Performance Security (To be Submitted by L 1 Firm Only)	3% of L 1 Estimate Value)
14	Address for Submission/Opening of such proposals	Science College (Autonomous), Hinjilicut-761102,  Ganjam, Odisha
15.	Website where Any corrigendum/other information to be uploaded. (No further advertisement will be given)	<ul style="list-style-type: none"> <li>• <a href="http://www.sch.edu.in">www.sch.edu.in</a></li> </ul>
16	Cost /fee of Tender Documents	<ul style="list-style-type: none"> <li>• Tender document is free of cost.</li> <li>• Tender documents can be downloaded from the college website i.e. <a href="http://www.sch.edu.in">www.sch.edu.in</a></li> </ul>

## **SECTION 2 : NOTICE OF INVITATION**

The Principal, Science College (Autonomous), Hinjilicut hereby invites proposals from reputed eligible firms located within State of Odisha to select supplier for Supply of Laboratory Equipments/Apparatus at the premises of Science College (Autonomous), Hinjilicut ".

1. Firm will be selected under "Least Cost Selection" method as per criteria mentioned in the RfP document.
2. The proposal must be complete in all respect as specified in the RfP document and must be accompanied with the required financial instruments as specified in the RfP.
3. The EMD should be submitted in form of a Demand Draft in favour of "Principal, Science College (Autonomous), Hinjilicut" Payable at "Hinjilicut" drawn in any scheduled commercial bank, without which the proposal will be rejected.
4. Performance security is to be submitted after issuing of Lol to the L1 bidder.
5. The proposals will be opened in the presence of the designated/ authorized representatives of the interested firm on the scheduled date & time at the specified address as mentioned in the "Schedule of RfP". Designated/authorized representatives of the interested firm may attend the meeting with due authorization letter on behalf of their firm.
6. Interested firms may obtain the RfP document from the official website of the college [www.sch.edu.in](http://www.sch.edu.in) and submit their proposal in a sealed document as per the instructions mentioned in this RfP document.
7. The interested firms must accept all technical / commercial terms & conditions mentioned in the RfP document.
8. The Principal, Science College (Autonomous), Hinjilicut reserves the right to cancel the RfP at any point of point without prior notices.

### **SECTION 3 : SCOPE OF WORK**

1. The Scope of Work must fulfill the requirements of the college like; the selected supplier must supply of Laboratory Equipments/Apparatus within the specific dateline e.g. within 15 days of issued of the "Supply Order".
2. The supplier must deliver and install required items at the college campus and no further time should be allowed for supply of the required goods without any valid reason and without the approval of the principal.
3. Once Laboratory Equipments/Apparatus is installed by the supplier at college campus, the training and demonstration of the Laboratory Equipments/Apparatus must be given by the supplier.
4. After installation, training and demonstration of the Laboratory Equipments/Apparatus is finished; if any issue arises with the item then the Principal of the college should immediately report in writing to the supplier.
5. After all issues are resolved, the supplier will submit the invoice to the college & the college will initiate the payment process within 15 working days of installation Laboratory Equipments/Apparatus.

## **SECTION 4: INSTRUCTIONS TO INTERESTED FIRMS**

### **1. PRE-QUALIFICATION CRITERIA**

The participating firms must produce copies of all the required supportive documents / information as part of their proposal, failing which the same proposal shall be summarily rejected.

Sl. No	Basic Requirement	Specific Requirement	Supporting Documents Required
1	Legal Entity	Firm must be a Company as registered under the provisions of the Indian Companies act Or A Partnership Firm registered under the Indian Partnership Act Or A Limited Liability Partnership registered under the limited Liability Partnership Act Or A Sole Proprietorship Firms	<ul style="list-style-type: none"> <li>• Certificate of Incorporation/ Registration</li> <li>• Partnership deed</li> <li>• GST Registration</li> <li>• PAN</li> </ul>
2	Experience	Interested firms altogether must have supplied goods as mentioned in the RfP at least once to any of the officers/ colleges/ universities.	Supply Order copies.
3	Turnover	During last three financial years i.e. FY 2018-19, 2019-20, 2020-21, the average annual turnover of the interested firm should not be less than 10% of the cost estimated by the college.	<ul style="list-style-type: none"> <li>• Audited balance sheet and “Profit &amp; Loss account” along with all schedules certified by a practicing Chartered Accountant.</li> <li>• Acknowledgement of Income tax returns</li> </ul>
4	EMD (EMD of unsuccessful firms will be returned immediately)	The interested firm should submit an EMD of Rs 1,60,000/-	Demand Draft in favour of “Principal, Science College (Autonomous)” Payable at Hinjilicut
5	EMD relaxation criteria	Firms registered under MSME are exempted from submitting the EMD.	Bid Security declaration and MSME/Start Ups proof.
6	Performance Security	3% of the L 1 value.	Demand Draft from a scheduled commercial Bank Or A Fixed Deposit Or A Bank Guarantee pledged in the name of “Principal, Science College (Autonomous), Hinjilicut
7	Blacklist	The Firm should not have been banned/ blacklisted/ debarred/ Suspended by the World Bank / Central Govt./ State Govt. / Central or State PSU Origination /Central or State Govt. Universities or Colleges.	Self –Declaration from the Firm as per the prescribed format mentioned at “FORM T4”.

## 2. VALIDITY OF PROPOSAL

- The proposal submitted by the interested firms will remain valid for one year. The authority/Principal reserves the right to procure further requirement of the items given in the tender from the selected firms within the validity period
- The selected firms must Supply of Laboratory Equipments/Apparatus as per the approved rate and within 15 days of receipt of the "Supply Order" from the college.
- Deviation from this may lead to disengagement of the selected firm and firm secured L2 position may be invited to supply and installation the Laboratory Equipments/Apparatus as per the terms and conditions of the RfP.

## 3. PRE-PROPOSAL QUERIES/MEETING

- Firms may submit their queries (if any) for pre-proposal meeting in respect of the RfP, to the principal, Science College (Autonomous), Hinjilicut only through e-mail [principalsch@gmail.com](mailto:principalsch@gmail.com) within the stipulated date and time mentioned in RfP document.
- Clarification to the above will be hosted in the official website of the college i.e. [www.sch.edu.in](http://www.sch.edu.in) after the pre-proposal meeting as per the schedule mentioned in RfP document.
- The pre-proposal query meeting may be conducted either in online or physical mode.

## 4. SUBMISSION OF PROPOSALS

- Interested firms are advised to study carefully all instructions, forms, terms & conditions and other important information mentioned in the RFP document.
- Each page should be signed with official seal of the authorized person.
- The proposal must be complete in all respect, properly indexed and hard bound.
- A sealed master envelope bearing the name, address, phone number and email id of firm along with the RfP name & number should contain two separate sealed envelopes i.e:
  - 1) Technical Proposal
  - 2) Financial Proposal
- The sealed “Technical Proposal” must contain the required supporting documents as per the sequence mentioned below:
- ✓ EMD through Demand Draft.
  - a) However; Micro, Small & Medium Enterprises registered with MSME /

NSIC with valid category wise certificate, duly issued by Government of India are exempted for submitting the EMD on the condition that they must have the valid & category wise valid registration certificate on the date of opening of tender.

b) EMD deposited by the unsuccessful firms will be returned immediately.

c) EMD deposited by the selected firm will be returned after submission of "Performance Security".

✓ **FORM T 1:** Technical Proposal Submission Form

✓ **FORM T 2:** Organization Details along with:

i) Copy of Certificate of Incorporation/ Registration

ii) Copy of PAN

iii) Copy of Goods and Services Tax Identification Number (GSTIN)

➤ **FORM T3:** Experience Details,

➤ **FORM T4:** Self declaration from the firm confirming not have been banned/blacklisted/ debarred/suspended.

➤ **FORM T5:** Technical Specifications Compliance Sheet.

➤ **FORM T6:** Financial Turnover Details along with:

- Copies of audited balance sheet, Profit & Loss account and all schedules certified by the Chartered Accountant.

- Copies of IT Return for the last three financial year i.e FY 2018-19, 2019-20, 2020-21.

- **FORM F 1:** Financial Proposal Submission Form.

✓ The sealed "Financial Proposal" must contain:

- The prices and other information having a bearing on the price shall be written both in figures and words in the prescribed form.

- No alternation / modification / overwriting / corrections in the format shall be accepted.

- The sealed proposal must be delivered at the specified address as per the "Schedule of RfP" through Speed Post/Registered Post / Courier only. The Principal shall not be responsible for postal delay or delay due to any unforeseen situation. Submission of proposal through any other mode will not be accepted.



## 5. OPENING OF PROPOSALS

- ✓ Sealed envelope containing the proposal will be opened by the Principal in presence of the firm/their representative at the location, date and time specified in the RfP document.
- ✓ Only one representative with proper authorization letter from the participating firm will be allowed to attend the RfP opening meeting.

## 6. DISQUALIFICATION/REJECTION OF PROPOSAL

The proposal is liable to be disqualified in the following cases as listed below:

- Proposals not conforming to the eligibility criteria and not submitting the required documents as mentioned in the RfP".
- Submission of forged documents.
- Proposal submitted without EMD.
- Proposal not submitted in accordance with the procedure and formats as prescribed in the RFP.
- Proposal received in incomplete form.
- Proposal received after due date and time.
- Proposal which is not accompanied by all the required documents/information.
- Firm trying to influence the proposal evaluation process by unlawful / corrupt/ fraudulent means at any point of time during the bid process.
- Price quoting in any irrelevant papers, documents, presentation etc except "Financial Proposal"
- If in case of a firm or any person acting on its behalf indulges in corrupt/ fraudulent practices.
- Any other condition / situation which holds the paramount interest of the PRINCIPAL during the overall selection process.
- The principal reserves the right to annul any/all of the proposals received, at any point of time with/without assigning any reasons thereof.

## 7. EVALUATION OF PROPOSALS

A two-stage process will be adopted as explained below for evaluation of the proposals:

### **A. Technical Evaluation**

- Technical evaluation of the proposals will be done to determine whether the proposal complies with the prescribed eligibility conditions and the requisite documents/ information/ financial instruments have been

properly furnished by the firm.

- Technical compliance as submitted along with the proposal will be done to determine whether the Brand & model, proposed by the interested firm consists of all required minimum specifications as mentioned at "Form T 5" of the RfP document.

## **B. Financial Evaluation**

- The financial proposals of the technically qualified firms only shall be opened at this stage in the presence of the technically qualified firm/their authorized representative on the scheduled date and time as mentioned in the RfP document.
- "Least Cost Selection Method" will be followed.
- The firm, who submits the lowest financial price proposal shall be declared as the "L1" bidder and shall be communicated for further process leading to issue of "Supply Order".

## **8. AWARD OF CONTRACT**

- The L1 bidder will be notified by the PRINCIPAL in writing by issuing a "Letter of Intent" and will be asked to acknowledge the "Letter of Intent (LoI)" and to submit the "Performance Security" within 15 days of issuance of the LoI".
- The "Performance Security" is unconditional and irrevocable.
- Performance Security amount is mentioned at Para 1 of "Section 4" and the Performance Security must remain valid till warranty period of the goods.
- After receiving the acknowledgement of LoI along with the "Performance Security", the PRINCIPAL will issue the "Supply Order to the selected firm", for their requirement as specified in the RfP document.
- After issue of "LoI" or after receipt of the acknowledged "LoI", if due to any reason(s) the L1 bidder withdraws its willingness to supply the required goods then the EMD/Performance Security deposited by the same firm will be forfeited by the PRINCIPAL and firm securing the L 2 position in the financial bid will be awarded with contract, after submission of the required Performance Security amount & EMD.
- Once the Supply Order is issued by the college, the concerned firm must supply and install the required number of items within 15 days from the date of issue of the supply order. No further time will be allowed without any valid reason and without prior approval of the same from the principal.

## 9. GENERAL TERMS & CONDITIONS

### ➤ **Conflict of Interest Exists in The Event of:**

- Firms who have a business or family relation with the PRINCIPAL, directly or indirectly.
- Practices prohibited under the anti-corruption policy of the Government of India and Government of Odisha. The interested firms are to be careful so as not to give rise to a situation where there will be any conflict of interest with the PRINCIPAL as this would amount to their disqualification and breach of contract.

### ➤ **Disclosure:**

- Firm has an obligation to disclose any actual or potential conflict of interest. Failure to do so will lead to disqualification of the bidder or termination of its contract.
- Firm must disclose if they are or have been the subject of any proceedings (such as blacklisting) or other arrangements relating to bankruptcy, insolvency or the financial standing of the firm, including but not limited to appointment of any officer such as a receiver in relation to the firm's personal or business matters or an arrangement with creditors, or of any other similar proceedings.
- Firm must disclose if they have been convicted of, or are the subject of any proceedings relating to:
  - ✓ A criminal offence or other serious offence punishable under the law of the land, or where they have been found by any regulator or professional body to have committed professional misconduct.
  - ✓ Corruption including the offer or receipt of an inducement of any kind in relation to obtaining any contract.
  - ✓ Failure to fulfill any obligations in any jurisdiction relating to the payment of taxes or social security contributions.

### ➤ **Anti Corruption Measure:**

- Any effort by firm(s) to influence the PRINCIPAL in the evaluation and ranking of financial proposals, and recommendation for award of contract, will result in the rejection of the proposal.
- A recommendation for award of contract shall be rejected if it is determined that the recommended firm has directly, or through an agent, engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the contract in question. In such cases, the PRINCIPAL shall reject the proposal and disqualify it from participating in any related RfP process.

➤ **Force Majeure:**

- "Force Majeure" means an event beyond the control of the selected firm and not involving the selected firm's fault or negligence and not foreseeable. Such events may include wars or revolutions, fires, floods, riots, civil commotion, earthquake, epidemics or other natural disasters and restriction imposed by the Government or other bodies, which are beyond the control of the selected firm, which prevents or delays the execution of the order by the selected firm.
- If a Force Majeure situation arises, the selected firm shall promptly notify PRINCIPAL in writing of such condition, the cause thereof and the change that is necessitated due to that prevailing condition. Until and unless otherwise directed by the PRINCIPAL in writing, the selected firm shall continue to perform its obligations as per the RFP terms & conditions as far as possible and shall seek all reasonable alternative means for delivering performance not prevented by the Force Majeure event.
- The selected firm shall inform the PRINCIPAL in writing, the beginning and the end of the above causes of delay, within seven days of the occurrence and cessation of the Force Majeure condition. In the event of a delay lasting for more than one month, if arising out of causes of Force Majeure, PRINCIPAL reserves the right to cancel the contract without any obligation to compensate the selected firm in any manner for what so ever reason.
- The PRINCIPAL and the selected firm shall make every effort to resolve amicably, by direct negotiation, any disagreement or dispute arising between them under or arising from or in connection with the contract.

➤ **Governing Laws:**

- Any unjustified and unacceptable delay in delivery shall render the selected firm liable for liquidated damages and thereafter the PRINCIPAL holds the option for cancellation of the contract for pending activities and completes the same through any other firm(s) who participated in the RfP process by awarding the same contract to L 2 bidder in the financial bid.
- In such case of premature cancellation the contract the PRINCIPAL reserves the right to withhold the Performance Security.
- The rights and obligations of the PRINCIPAL and the selected firm under this contract will be governed by the prevailing laws of Government of India and Government of Odisha only.
- All legal disputes are subject to the jurisdiction of the Orissa High Court, Cuttack.

**SECTION 5: FORMS**

**FORM T 1: TECHNICAL PROPOSAL SUBMISSION FORM**

To,

The Principal,

Science College (Autonomous), Hinjilicut

Sub: Submission of Technical Proposal to select supplier for Supply of Laboratory Equipments/Apparatus at the college.

REF: 11342302/OHEPEE/ 2022-23/11 Dated: 16.11.2023

Dear Sir,

I, the undersigned, offer to participate in the selection process to select supplier for "Supply of Stools" at the college, in accordance with your RFP No: 11342302/OHEPEE/ 2022-23/11

I am here by submitting Technical Proposal, which includes EMD, Technical Proposal and Financial Proposal sealed in separate envelopes. I, hereby declare that all the information and statements made in the Technical & Financial Proposals are true and correct. I accept that any misinterpretation contained in it may lead to disqualification of my proposal.

I hereby unconditionally undertake to accept all the terms and conditions as stipulated in the RFP document. In case any provision of this RFP are found violated, then your College shall without prejudice to any other right or remedy be at liberty to reject our proposal including forfeiture of the full said earnest money deposit absolutely.

Yours faithfully,

Authorized Signatory of the firm with Date and Seal

## FORM T 2: ORGANISATION'S DETAILS

Sl. No	Particulars	Details
1	Name of the Firm	
2	Type of Firm (Proprietary/ Partnership/ Pvt. Ltd. / Public Ltd/ Sole Proprietorship)	
3	Date of Establishment and Experience in business(In number of years)	
4	Registered office Address & Complete postal address	
5	Local office in Odisha (along with address & contact details).	
6	Telephone & e-Mail id of authorized person	
7	G.S.T. Registration No.	
8	PAN No.	
9	Willing to carry out assignments as per the scope of work of the RFP (Yes/No)	
10	Willing to accept all the terms and conditions as specified in the RFP (Yes/No)	

Yours faithfully,

Authorized Signatory of the firm with Date and Seal

**FORM T 3: EXPERIENCE DETAILS**

Sl No	Name of the University/College/Department/Office to whom materials /Laboratory Instruments/equipments supplied	Quantity of the material supplied	Date of Receipt of work order with reference number	Date of supply of Goods/Items/ Completion	Remarks
1					
2					
3					
4					
5					

Yours faithfully,

Authorized Signatory of the firm with Date and Seal

**FORM T 4: SELF DECLARATION FOR NOT BLACK LISTED**

To,  
The Principal,  
Science College (Autonomous), Hinjilicut

Sub: Self declaration for not black listed.

Ref: 11342302/OHEPEE/ 2022-23/11, Dated:16.11.2023

Sir,

I/We..... here by confirm that our firm has not been  
banned/ blacklisted/ debarred/suspended by the World Bank/Central  
Govt./State Govt./ Central or State PSU Origination/Central or State Govt.  
Universities or Colleges.

Yours faithfully,

Authorized Signatory of the firm with Date and Seal



## FORM T 5: Minimum Required Specifications Compliance Sheet

Interested firm(s) must confirm that, the make and model they are proposing to supply & install is satisfying the below mentioned minimum required technical specifications. Deviations (if any) from the below mentioned minimum required technical specifications, must be clearly indicated by the interested firm(s).

### DEPARTMENT OF BOTANY

Sl. No.	Name of the Equipment/Apparatus	Minimum Required Specifications	Compliance (Yes/No)	Deviations
1	<b>UV-VIS Spectrophotometer With Scanning Software</b>	German Technology with Wavelength Range: 190 Nm-1000 Nm, Bandwidth: 1 Nm Wavelength Accuracy: $\pm 1$ Nm Wavelength Repeatability: 0.5 Nm Wavelength Setting: Auto Photometric Accuracy: $\pm 0.5\%$ T Photometric Repeatability: 0.3% T Photometric Range: -0.3-3a,0-200%T Stray Light: $<0.3\%$ T Stability: $\pm 0.002$ A/H @500 Nm Display: 128*64. Lcd, Detector: Silicon Photo diode		
2	High Speed Refrigerated (Cooling) Centrifuge	High Speed Refrigerated Centrifuge with Angle Rotor tubes of 2.2 MI with speed of 16000RPM, brushless motor . Digital, premium brushless model microprocessor based. Max. speed 20000rpm. When we fix 12*2ml angle rotor head. Further speed depends upon rotor being used. Fitted with microprocessor based 4 lines 20 character each LCD Pannel for 1 seconds to 99 minutes countdown timer, digital rpm-rcf meter and programmable speed controller. Stand by temperature from -20*C to+40*C is controlled by microprocessor based digital temperature controller cum indicator, with voltage stabilizer		
3	Digital AUTOCLAVED VERTICAL HIGH PRESSURE (TRIPLE WALLED)	Autoclave Vertical:- Supplied with SS Inner chamber SS Outer Body SS Basket & SS Lid., with wing Nut closing arrangement Inner chamber (a) 200x450 mm - 1.5 KW Capacity: 22 Liter (b) Automatic low water level cut of device (c) Pressure Gauge with proper gasketing. (d) with padel lifting device		

4	SPINIX -TM Vortex Shaker	SPINIX TM MC-01 with speed control includes Cat 3001, 3002, 3003, 3004 with Fiber made culture Reck (6'x3') fitted with adjustable glass selves.		
5	Binocular Microscope	<p>Inclined at 45°, Inter pupillary Distance 55-75mm,360° Rotate blend Dioptric adjustment. Anti fungus Treated Stand :Sturdy stand with anti-rust materials a Ergonomic carrying grip enables easy transportation.</p> <p>Eyepiece : Wide Field eyepiece WF 10x/18 mm ( paired)</p> <p>Nosepiece:Quadruple Nosepiece (Ball bearing Type with click stops and rubber ring)</p> <p>Objective :Achromatic objectives 4x/ NA 0.10, 10x/ NA 0.25 , 40x/ NA 0.65 (SL), 100x/ NA 1.25 (SL, Oil)</p> <p>Mechanical Stage :Graduated mechanical stage 140 mm x 120 mm, moving area 80 mm (x), x 50 mm (y) with co-axial controls</p> <p>Focusing:Ergonomic designed Co-axial Coarse and Fine focusing system on ball drive for smooth operation with tension control ring</p> <p>Condenser :Abbe Condenser N.A = 1.25 with Iris Diaphragm and swing out Filter Holder, Moving Up and Down</p> <p><b>Illumination System</b> :Built-in bright white LED, brightness adjustable with intensity control regulator Electronics :Power input 220V AC, 50 Hz</p>		
6	Trinocular Compound Microscope with Monitor 9 inch & SONY Sensor (Android Version)	<p>Trinocular Head with Inclined at 45°, Inter pupillary Distance 55-75mm,360° Rotate blend Dioptric adjustment. Anti fungus Treated Stand :Sturdy stand with anti-rust materials a Ergonomic carrying grip enables easy transportation.</p> <p>Eyepiece : Wide Field eyepiece WF 10x/18 mm ( paired)</p> <p>Nosepiece :Quadruple Nosepiece (Ball bearing Type with click stops and rubber ring)</p> <p>Objective :Achromatic objectives 4x/ NA 0.10, 10x/ NA 0.25 , 40x/ NA 0.65 (SL), 100x/ NA 1.25 (SL, Oil)</p> <p>Mechanical Stage :Graduated mechanical stage 140 mm x 120 mm, moving area 80 mm (x), x 50 mm (y) with co-axial controls</p> <p>Focusing :Ergonomic designed Co-axial Coarse and Fine focusing system on ball drive for smooth operation with tension control ring</p> <p>Condenser :Abbe Condenser N.A = 1.25 with Iris Diaphragm and swing out Filter Holder, Moving Up and Down</p>		

		<p><b>Illumination System</b> :Built-in bright white LED, brightness adjustable with intensity control regulator  Ele:Power input 220V AC, 50 Hz  Sensor: 1/2.5”, Effective pixel: 5M, Screen: 9.7”, Resolution 2048*1536@15Fps retina screen  Operation system: Android 5.1.1 version  Wifi: 2.4GHz/5GHz dual bands WIFI support 802.11a/b/g/n/ac protocol  <b>Bluetooth: Bluetooth 4.0</b> or more Output: USB2.0, HDMI, WIFI, TF card  Pixel size: 2.2um*2.2um Power: DC-12V/2A  Basic function: Brightness, Contrast, Saturation, White balance  Image adjustment: Exposure, Sharpness, Gamma, Color temperature  Camera function: Mirror, Flip UI interface: Support mouse and touch control  Image/Video: Support 16M image capture, support 1080P video  Storage function: Image capture, Video, Preview, SD card formatting  Labeling function: Point coordinates, cross lines, coordinate systems, text annotations  Length measurement: Line length, Broken line length, Curve length, Parallel &amp; Point line distance.  Geometric measurement: Line length, radius defining circle, two point defining circle, three point defining circle, concentric circles The geometric area: Polygon, square</p>		
7	Electrophoresis unit	<p>Mini Submarine Electrophoresis Unit  15x10 cms  (a) Electrophoresis Power Supply Unit  Mini Dual Vertical Electrophoresis Unit</p>		
9	Analytical Digital Balance	<p>Accuracy 0.001gm ,Capacity-300gm, 8 inch Touch Screen with Digital Display with Battery backup option</p>		
10	Micro-Pipette	<p>p10µl, 100 µl, 1000 µl</p>		
11	Hot Air Incubator	<p>with 50 Liters capacity &amp; Temperature setting range from RT+5<sup>0</sup>C to 65<sup>0</sup></p>		
12	Compound Microscope	<p>Objectives: (SL) inclined head, Rotatable 360, Built in LED Illumination with paired eye piece, 10X &amp; 15X wide filed paired , Objective-10x and 45x on quick changing Turrent Oil immersion with 6volt 20 watt LED Illumination</p>		
13	Dissecting Microscope	<p>All brass parts, heavy weight deluxe model  Eyepieces: 10x &amp; 20x</p>		

14	Permanent Slides with slide cabinet	With trolley		
15	Farmer's potometer	The apparatus consists of a central reservoir with a three whole stopper holding a capillary tube graduated in millimeters, a funnel with stopcock and a short length of 10 mm glass tubing, to hold the plant shoot. Reservoir 100 x 65 mm height and diameter, capillary tube 390 mm long 1 mm bore, graduated 0- 300 mm x 1 mm, funnel 25 ml Capillary bore 1 mm		
16	T/A Apparatus	To measure the quantity of water absorbed and given off by a transpiring plant. Consists of a glass vessel 250 x 50 mm with rubber stopper at top & a side tube graduated 0-15 cm x 1 cm.		
17	Ganong's potometer	Height to top of reservoir 170mm Diameter of reservoir 20mm Length, overall 320mm Base 20 x 80 mm length x width Capillary bore 1mm As above but on Bakelite Stand.		
18	Measuring Cylinder	Glass made Graduated 10ML., 20 ML, 50ML., 100ML.		
19	Volumetric Flask	Glass made Cap: 10ML., 20 ML, 50ML., 100ML.250ML., 500ML. & 1000ML.		
20	Beaker	Glass made Cap: 250ML., 500 ML., 1000ML.		
21	Conical Flask	Glass made Cap: 250ML., 500 ML., 1000ML.		
22	Willmout's Bubbler	Wilmott's bubbler consists of a wide mouthed bottle fitted with a cork through which is inserted a glass tube. The lower end of this tube is fitted with a cork with hole through which a twig of Hydrilla plant is inserted; its other end terminates in a narrow bent nozzle.		
23	Slide pic	thin flat piece of <a href="#">glass</a> , typically 75 by 26 mm (3 by 1 inches) and about 1 mm thick,		
24	Cover slip	24x32mm x 0.13-0.17mm		300
25	Deep Freezer(-20C)	Double walled construction, Capacity 170 Ltr - GMP series with 6 Cuft with Digital PID Controller, Temperature Range : -20°C, Temperature Accuracy : ± 3°C Refrigeration by means of CFC Free hermitically sealed Emerson Copland make compressor with R 134A for better cooling. Full view observation Glass/Acrylic door with gasket to observe sample in side the chamber. Specially designed stainless steel rod trays ensure uniform temperature distribution.		
26	<b>Digital pH meter with ATC</b>	Microprocessor Based, Display : 16 x 2 Alphanumeric, Range : 0 to 14 pH, 0 to 1000mV, Resolution : 0.01 pH, 0.1 mV, Accuracy : ± 4%,		

		Temperature Compensation: Manual, Calibration : 3 Point, Dimension : 275 x 187 x 94 mm (Approx), Power : 220 V $\pm$ 10 v AC, Accessories : pH Electrode, Electrode Stand, 3 Buffers and Operating Manual		
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## DEPARTMENT OF ELECTRONICS

Sl. No.	Name of the Equipment/Apparatus	Minimum Required Specifications	Compliance (Yes/No)	Deviations
1	Phase and Frequency Determination of Electrical Signals using a CRO	Study of CRO, Measurement of time period, Measurement of amplitude, Measurement of frequencies, Measurement of phase angle Known frequency 50Hz (3 V DC at 50 mA) One inductor, One capacitor, Resistance selector switch Supplied with CRO 20 MHZ Dual Trace Oscilloscope, Audio Frequency Generator 20 Hz to 200 KHz O/P 0-20V RMS		
2	Verification of Kirchoff's Law	To verify Kirchoff's Law and Kirchoff's Voltage Law 0-10V DC at 10mA continuously variable power supply, DC voltmeter 65mm rectangular 0-10V, DC Milliammeter 65mm rectangular dial 0-10mA		
3	Verification of Norton's Theorem, Verification of Thevenin's Theorem Verification of Superposition Theorem Verification of Maximum Power Transfer Theorem	Verification of Superposition theorem, Verification of Maximum power transfer theorem, Verification of Thevenin's theorem and to find equivalent voltage source circuit and Verification of Norton's theorem and to find equivalent current source circuit.		
4	RC Circuit: Time constant, Differentiator, Integrator	RC Circuit : Time constant, Differentiator, Integrator		
5	Designing of a Low Pass RC Filter and Study of its frequency response Designing of a High Pass RC filter and study of its frequency response.	Mains transformer having secondary tappings of 10V, 20V, 30V, 40V , 50V AC at 500mA , DC Voltmeter 65mm rectangular dial with switch selectable ranges of 10V, 20V,30V,40V and 50V, Four rectifier diodes, SPDT switch, Supplied with Decade Audio Frequency Generator, Digital Stop Clock and Cathod Ray Oscilloscope		
6	Study of the I-V Characteristics of Semiconductor Diode	0-10V DC at 50mA continuously variable with fine and course pot power supply. , DC Voltmeter 65mm rectangular dial 1V & 10V , DC Microammeter 65mm rectangular dial with 50mA and 10mA, Ge and Semiconductor Diodes.		
7	Study of the I-V Characteristics of Zenor Diode	0-10V DC at 10mA continuously variable power supply with low ripple and hum and integral current limiting resistor, DC Voltmeter 65mm rectangular dial 1V & 10V , DC Microammeter 65mm rectangular dial with 50mA and 10mA, Germanium semiconductor diode and Zenor diode.		
8	Study of I-V characteristics of the CE configuration of	Two 0-10V DC at 50mA continuously variable power supply for Base Emitter and Collector Emitter		

	<p>BJT and obtain <math>r_i, r_o, \beta</math></p> <p>Study of the I-V characteristics of the Common base configuration of BJT and obtain <math>r_i, r_o, \alpha</math></p> <p>Study of the I-V characteristics of the common collector configuration of BJT and obtain gain, <math>r_i, r_o</math></p>	<p>junctions, Two DC Ammeters 65mm rectangular dial with selectable ranges 200mA and 10mA, Two DC Ammeters 65mm rectangular dial with switch selectable ranges of 200mA and 10mA, Two DC voltmeters 65mm rectangular dial with selectable ranges 1V &amp; 10V, Two silicon (NPN and PNP) transistors.</p>		
9	Study of the I-V characteristics of the UJT	Two 0-30V DC at 50mA continuously variable regulated power supply, DC voltmeter 65mm 0-35V, DC Ammeter 0-5mA, Unijunction transistor, Supplied with Cathod Ray Oscilloscope		
10	Study of I-V characteristics of the SCR	<p>To study the DC gate control of a SCR</p> <p>To study and plot the anode current characteristics of a SCR</p> <p>To measure the holding current of SCR</p> <p>0-50V DC at 50mA continuously variable power supply for anode, 0-3V DC at 50mA continuously variable power supply for Gate, 0-10V AC at 50 Hz variable power supply for Anode, DC voltmeter 65mm rectangular 1V &amp; 50V, DC Milliammeter 65mm rectangular 0-50mA, Silicon controlled rectifier.</p> <p>Supplied with Vacuum Tube Voltmeter and Cathod Ray Oscilloscope</p>		
11	Study of the I-V characteristics of FET	0 to 20V DC at 50mA continuously variable power supply, 0-12V DC at 50mA continuously variable power supply, Two DC voltmeter 65mm rectangular to read 0-20V, DC Milliammeter 65mm rectangular dial to read 0-20mA, Field effect transistor.		
12	Study of I-V characteristics of MOSFET	<p>To determine experimentally the Drain characteristics of a given MOSFET</p> <p>To study the use of MOSFET as an amplifier and to measure its voltage gain in common source configuration.</p> <p>Supplied with Audio Frequency Generator, AC Millivoltmeter and Cathod Ray Oscilloscope.</p>		
13	Study of characteristics of Solar Cell	<p>To study of the followings</p> <p>Illumination Characteristics, Current Voltage Characteristics, Power-load characteristics and Areal characteristics.</p> <p>Digital DC Ammeter dual range 3 ½ digit, Digital DC Voltmeter dual range 3 ½ digit, Digital DC Voltmeter 3 ½ Digit, Nine different resistance values selected by a band switch, Solar Cell, Table Lamp and Five different area choppers.</p>		
14	Study of Hall Effect	Hall Effect board: Digital meter to read Hall voltage (0-200mV) and probe current (0-20mA) selectable by switch. It also provides constant current power supply.		

		<p>Hall Probe: Germanium Single Crystal N or P type with 4 spring type pressure contact, Resistivity- 8-10 ohms.cm , Zero-field potential- &lt; 1mV adjustable, Hall voltage- 25-35mV/10mA/KG</p> <p>Electromagnet: 7.5 kg at 10mm air gap, Pole pieces 50mm Diameter, Energizing coils – Two each a resistance of about 3.0 ohm.</p> <p>Constant current range: 0-4 Amp. Power supply , Load regulation: Better than 0.5% , Line regulation: Better than +/- 2% , Metering : 3 ½ Digit LED DPM</p> <p>Digital gauss meter: Operates on the principle of Hall effect in semiconductor, Hall probe stand wooden.</p>		
15	To determine Young's Modulus of a wire by Optical Level Method	To determine Young's Modulus of a wire by Optical Level Method		
16	To Determine the modulus of rigidity of wire by Maxwell's needle	Maxwell's Needle consist of a hollow cylindrical brass tube of length 40cm suspended by a wire whose modulus of rigidity is to be determined. The hollow cylinder filled with four brass cylinders two solid and two hollow, each having 10 cm length and same radius. It is fitted with wire chuck and mirror. Supplied with Digital Stop clock and Laser light pointer.		
17	To determine elastic constant of a wire by Searle's method	To determine elastic constant of a wire by Searle's method		
18	To measure the resistivity of a Ge crystal with temperature by four probe method from room temp to 200°C	Probe arrangement, Germanium crystal , Oven maximum temp about 200°C, Four probe set ups, Constant current generator, Digital panel meter.		
19	To determine the value of Plank's Constant by using LED's of at least 4 different wavelengths.	0-5 V DC at 2mA continuously variable IS regulated power supply with 1K ten turn potentiometer for fine voltage control, Digital panel meter 3 ½ digit 20 V DC, Digital panel meter 3 ½ digit 2000mA DC, Four different colour LED's		
20	To determine e/m of electron by Bar magnetic focusing	Cathod Ray Tube (CRT) fitted on stand with a scale for measuring position of magnetic coil , A magnetic coil whose axis of the tube and is free to move from screen to electron gun of CRT, High voltage power supply voltage varied from 1200 to 1500V and digital voltmeter to read the voltage, Power supply to operate the magnetic coil DC supply of 30V at 0-1.5Amp. , Two potentiometer to control the intensity and focus of CRT.		
21	To study the Half Wave Rectifier and Full Wave Rectifier	Junction Diode Rectifier and Filter Characteristics Mains transformer, secondary centre tap 100-0-100V at 100mA, DC Milliammeter 0-100, DC voltmeter 0-300V, Four Silicon junction diodes, Filter choke Supplied with AC Millivoltmeter		

22	Study of Power Supply using C filter and Zenor diode	Study of Voltage and Current regulated power supplies Mains transformer with tappings for 0.9 and 14V AC at 150mA, DC Milliammeter range 1mA,10mA and 100mA selectable, DC voltmeter 0-30V, Voltage regulator, NPN transistor, Zenor diode.		
23	Designing and testing of 5V/9V DC regulated power supply and find its load regulation	To study half wave rectification, To study full wave rectification, To study measurement of ripple and ripple reduction, To study Zenor diode voltage regulator circuit, To study series regulator with current limiting, A study a shunt voltage regulator, To study a 0-9 V DC continuously variable voltage regulator power supply and measure the Line regulation, Load regulation and Ripple factor. Supplied with 0-200 mA DC Milliammeter, 0-15 V DC voltmeter, Variac 0-270 V at 2 Amp and Cathod Ray Oscilloscope		
24	Study of Clipping and Clamping circuits.	Study of Positive base clipping with diode in series, To study positive base clipping with diode in shunt, Study of Negative base clipping with diode in series, To study Negative base clipping with diode in shunt, To study Negative peak clipping, To study Positive peak clipping and Study of series and shunt clamping circuits. Supplied with Cathod Ray Oscilloscope and Sine Square wave Oscillator		
25	Study of Fixed bias, voltage divider and collecot-to-base bias feedback configuration for transistor.	Study of Fixed bias, voltage divider and collecot-to-base bias feedback configuration for transistor.		
26	Designing of a single stage CE amplifier Study of Class A,B and C power amplifier	Single and Two stage R.C Coupled amplifier Supplied with Decade Audio Frequency Generator, AC Millivoltmeter, Decade resistance box		
27	Study of the Culprit's Oscillator Study of the Hartely's Oscillator	RF (L-C) Oscillators (Hartley's, Colpit's ) with power supply Supplied with Absorption wave meter		
28	Study of the Phase Shift Oscillator	To study Phase Shift Audio Oscillator circuit using a single transistor and To study the improved Phase Shift Oscillator circuit using two transistors Supplied with Cathod Ray Oscilloscope		
29	Study of the frequency response of common source FET amplifier	FET Characteristics and Amplifier		
30	To study and verify the characteristics of basic logic gates	Logic Gate Circuit Trainer Output DC voltage fixed 5V+/-1% Output current 1Amp Load regulation +/-1% of the highest specified output voltage ( no load to full load) Basic Logic Gates: Four AND gates, Four OR gates, Four NAND gates, Four NOR gates, Six NOT flip flop		



		units gates, Dual J-K flip flop, J-K Master/slave flip flop and Dual D-type flip flop. Verification of AND, OR, NOT, NAND, NOR Gates and their truth table.		
31	To verify and design AND , OR NOT and XOR gates using NAND gates.	To study the OR, AND & NAND logic gates and to verify the truth table To make various logic functions (OR,NOR,NOT, AND & EX-OR gates) by using NAND gates and verify their truth table.		
32	Design a Half and full adder Design half and full subtractor	Design a Half and full adder Design half and full subtractor		
33	Design a Seven segment display driver	Design a Seven segment display driver		
34	Design a 8 x 1 multiplexer using gates	To study 8-bit Digital multiplexer with 8 inputs & one multiplexed output using IC 74151		
35	To build flip-flop circuits using elementary gates (RS, CLOCKED RS, D-TYPE)	Study of Basic gates and verification of their truth table Construction and verification of various types of Flip-flops using Gates & IC's RS Flip-Flop using NAND gates, RS Flip-Flop using NOR gates, Clocked R-S Flip-Flop, J-K Flip-Flop, J-K Flip-Flop with Clocks, D Flip-Flop		
36	Design a counter using D/T/JK Flip-Flop	To study the Up-Counter, To study the Down Counter and To study the Decimal Counter		
37	Study of op-amp characteristics	+/- 15V DC at 50mA IC regulated power supply, Two 0-6V DC at 50mA continuously variable power supplies, One 0-10V DC at 50mA continuously variable power supply, One -10V DC at 50mA IS regulated power supply, One DPM 3 ½ digit to read 0-20V, Three OP-AMP ICs 741, One potentiometer Supplied with Function Generator and Cathod Ray Oscilloscope		
38	Designing of an amplifier of given gain for an inverting and non-inverting configuration using op-amp.	To study Inverting Operational Amplifier To study Non-Inverting Operational Amplifier To study frequency response of Inverting A.C Operational Amplifier To study frequency response of Non-Inverting A.C Operational Amplifier To study High input Impedance of Inverting Amplifier To study High input Impedance of Non-Inverting Amplifier. Supplied with Sine Square Wave Oscillator, Digital Multimeter, A.C Millivoltmeter and Cathod Ray Oscilloscope		
39	Designing of analog adder and subtractor circuit	Designing of analog adder and subtractor circuit		
40	Designing of an Integrator using op-amp for a given specification and study its frequency response. Designing of a differentiator using op-amp for given specification and	Integrating Amplifier for DC input signals Integrating Amplifier for AC input signals Differentiator Amplifier and Non-Inverting differentiator Supplied with Digital Multimeter and Cathod Ray Oscilloscope		

	study its frequency response			
41	Designing of a first order low-pass filter using op-amp Designing of a first order high-pass filter using op-amp	Low Pass Filter Upper cut-off frequency: 1 KHz Cut-off slope: 29.5 dB/decade Input impedance: 3.5 K at 1KHz Output impedance: 18 ohms at 1KHz High Pass Filter Upper cut-off frequency: 100 Hz Cut-off slope: 26 dB/decade Input impedance: 12K at 100Hz Output impedance: 300 ohms at 100Hz		
42	Designing of a RC phase shift oscillator using op-amp	+9V DC at 100mA IC regulated power supply, Two stage buffer/amplifier using PNP transistor and controllable A.C gains, NPN transistor biased in class A common emitter configuration, R-C Phase Shift Network (advance type and retard type) , 3.579 MHz X-tal with series trimmer. Supplied with Cathod Ray Oscilloscope		
43	Study of IC 555 as an astable multivibrator Study of IC 555 as monostable multivibrator	+10V DC at 100mA IC regulated power supply, 1 KHZ Square wave generator, IC 555 Supplied with Vacuum tube voltmeter, Digital multimeter and Cathod Ray Oscilloscope		
44	Designing of fixed voltage power supply using IC regulators using 78 series and 79 series	Designing of fixed voltage power supply using IC regulators using 78 series and 79 series		
45	Design of multi range ammeter and voltmeter using galvanometer	To convert a Galvanometer into Volt / Amp. Meter and study resistance laws and a multimeter To convert a Galvanometer into a Voltmeter of a given range and to calibrate it To convert a Galvanometer into an Ammeter of a given range and to calibrate it. Supplied with 3 ¾ Digit Digital multimeter and Post office box		
46	Measurement of resistance by Wheatstone Bridge and measurement of bridge sensitivity	+5V DC at 100mA IC regulated power supply, Galvanometer to read 30-0-30, Six-decade resistance of different range.		
47	Measurement of capacitance by De-Sautys	De-Sauty Bridge with Oscillator and Detector		
48	Measurement of low resistance by Kelvin's double bridge	Industrial Kelvin- For precise measurement of low resistance capable of measuring resistance from 0.02 mili ohms to Double bridge 11 ohms Ten standard resistances are provided in steps of 0.01ohm each in dial form with five multiple ratios of 0.01, 0.1,1,10 and 100 ohms. The circular slide wire of 0.01 ohm divided into 500 equal parts, current up to 5 Amp continuously and 10 Amp. Conductivity- Wire holding device designed for the determination of resistance of cables and wires. Constant current- Current continuously adjustable 0 to 10 Amp. Up to 1.5 Volts.		

49	Determination of the characteristics of resistance transducer – strain gauge ( Measurement of strain using half and full bridge)	Measurement of strain using Strain Gauge		
50	Determination of the characteristics of LVDT	Board having following built in parts +/- 12V DC at 50mA IC regulated power supply for sine wave oscillator 4KHz fixed Sine wave oscillator having variable amplitude 0-10V (P-P) Digital panel meter 3 ½ digit range 200mV Detector circuit with output adjustment pot Transducer: Linear variable differential transducer, Range +/- 20mm (accuracy +/-1 mm, 1 Digit)		
51	Study of Transducers like AD590 (two terminal temperature sensor)	Study of Transducers like AD590 (two terminal temperature sensor)		
52	Study of characteristics of LDR, Photodiode and Phototransistor	Two 0-10V DC at 100mA continuously variable regulated power supplies, DC Milliammeter to read 0-10mA, DC Microammeter with selectable ranges 50mA, 500mA , 5mA and 50mA, DC Voltmeter of range 1V and 10V, Oto Electronic devices. Supplied with Variac 0-230V, 50Hz at 2Amp and Table lamp		
53	Characteristics of one Solid State Sensor / Fiber Optic Sensor	Characteristics of one Solid State Sensor / Fiber Optic Sensor		
54	Study of Amplitude Modulation Study of Amplitude Demodulation	+9V DC at 100mA IC regulated power supply, Carrier generator circuit, Modulating Circuit based on two transistors, Demodulating circuit. Supplied with Decade Audio Frequency Generator and Cathod Ray Oscilloscope 20 MHz		
55	Study of Frequency Modulation Study of Frequency Demodulation	+/- 12V DC at 100mA IC regulated power supply, Carrier generator circuit, Audio frequency modulating signal, Variiabe DC to see the frequency deviation in carrier frequency, Frequency Modulation circuit, Demodulating circit. Supplied with Decade Audio Frequency Generator, Digital Frequency Counter 6 Digit, Cathod Ray Oscilloscope 20MHz		
56	Study of Pulse Amplitude Modulation	+/-9V DC at 100mA IC regulated power supply , Variable frequency sampling pulse generator, Sine wave audio frequency modulating signal generator, PAM Modulator circuit based on an operational amplifier. Supplied with Cathod Ray Oscilloscope 20 MHz		
57	AM Transmitter Trainer	AF Modulating signal generator: Sine wave Frequency range 300Hz to 3.4 KHz RF carrier signal oscillator Frequency range- 100KHz to 1MHz, Amplitude 0 to 10Vpp Modulator (Two nos) Double balanced Amplitude modulator Ceramic Band pass Filter – 452 KHz to 458 KHz Band pass filter 1 no +/- 12V DC and 5V DC IC regulated power supply Test point 27 nos, BFO Oscillator: 455 KHz Dynamic microphone with		

		4mm Jack pin Supplied with Cathod Ray Oscilloscope 20 MHz		
58	AM Receiver Trainer	+/- 12V DC and +5 V DC IC regulated power supply Detectors/ Demodulator- 1. Diode detector (for DSB) 2. Product detector for ( For SSB) Refequency range: 980KHz to 1650 KHz Intermediate frequency: 455KHz Test points: 50 Audio output amplifier with volume control Supplied with Cathod Ray Oscilloscope 20MHz		
59	FM Transmitter / Receiver	FM Transmitter / Receiver		
60	Study of Amplitude Shift Keying	+/- 12V DC at 50mA IC regulated power supply, +/- 5V DC at 50mA IC regulated power supply, Clock Generator, 8 Bit word generator, Binary counter (Divided by 16 counter), Carrier signal generator 40 to 100KHz, Amplitude Shift Key (ASK) Modulator, Amplitude Shift Key (ASK) Demodulator Supplied with Cathod Ray Oscilloscope 20MHz		
61	Study of Phase Shift Keying	+/-5V DC at 100mA IC regulated power supply, Op-Amp IC, Decade counter IC, Quad Op-Amp IC, Multiplexer IC, Quad , 2-input EX-OR gate IC. Supplied with Cathod Ray Oscilloscope 20 MHz		
62	Study of Frequency Shift Keying	+/- 12V DC at 20mA IC regulated power supply, 5V DC at 100mA IC regulated power supply, Quad OP-amp IC, Decade counter IC, Timer IC, 4-Bit Binary counter IC, Quad 2-Input NAND gate IC, Two potentiometer for varying the FSK input and output of demodulator adjustment. Supplied with Cathod Ray Oscilloscope 20MHz		
63	To verify the law of Malu's for plane polarized light	Supplied with Optical bench : two 100 cm long steel rods ½ inch dia , Halogen lamp with house, Double convex lens, Polarizer and Analyzer fitted at the end of metallic tube and both are capable of rotation about a common axis , Photo voltaic cell , Micrometer having 0-50mA range		
64	To determine wavelength of Sodium light using Michelson's Interferometer	To determine wavelength of Sodium light using Michelson's Interferometer		
65	To determine wavelength of Sodium Light using Newton's rings	Supplied with Newton's Ring apparatus , Wooden reflector, Travelling Microscope Bridge type body , Sodium light source 35 watts with vacuum jacket transformer and wooden box having 4 holes with slide covers , Double Convex Lens with stand and Spherometer.		
66	To determine Resolving power and Dispersive power of Diffraction Grating	Spectrometer standard 6" dia circle reading 30 seconds, Diffraction grating Hilger & Watts type 15000 lines per inch, Sodium light source 35 watts with vacuum jacket transformer and wooden box having 4 holes with slide covers, Mercury light source 80W with choke and wooden box Prism 38 x 38mm, (Slit) attachment for reading power of telescope, Reading lens and Spirit level 60/80mm length.		
67	Diffraction experiment using laser	Supplied with He-Ne Laser with power supply and wave length of 670nm visible red, Circular Table (Spectrometer scale 6" dia with vernier but without collimeter& telescope and having two holders one for Laser & other for Laser Detector), Laser Detector,		

		Diffraction grating Hilger & Watts type 15000 lines per inch, Nanoammeter, Reading lens and Spirit level of 60mm length.		
68	Study of Faraday rotation Study of Electro-optic effect	Farraday effect –Magneto Optic effect Supplied with Electromagnet, Constant current power supply 0-4Amp, Sodium light source 35 watts with vacuum jacket transformer and wooden box having 4 holes with slide covers, Digital Gauss Meter, Vernier caliper, Two Polaroid mounted on a graduated circular scale 360 <sup>0</sup> , Glass cube ( Three hollow cube made of glass 3.9 x 3.9x 3.9 filled with Glycerine, Potassium chloride and Potassium iodide solution and sealed), Telescope with stand, Collimeter with stand, Wooden block size 3.5 x 6.0 x 9.5cm.		
69	To determine the specific rotation of can sugar using polarimeter.	Supplied with Polarimeter fitted with imported lauent's half shade system, with stand 20cm long polarimeter tube of borosil glass with 360 <sup>0</sup> rotation. Sodium light source 35 watts with vacuum jacket transformer and wooden box having 4 holes with slide covers, Transformer and wooden box having four holes with slide covers. Supplied with Physical Balance and weight box.		
70	To determine characteristics of LEDs and photo detector	Diode & Zenor Diode & LED characteristics		
71	To measure the numerical aperture of an optical fiber.	IC regulated DC power supply, Fibre-Optic Analogue transmitter @660nm, x Fibre-Optic Analogue transmitter @ 850nm, Fibre-optic receiver, One meter PMMA Fibre patch cord, Five meter PMMA Fibre patch cord, In-line SMA adaptor, Two potentiometer to vary forward current of LED in Transmitter & current of phototransistor in receiver, SPDT switch selecting wavelengths 660nm & 850nm, NAJIG with scale marked on it to measure length, NA measuring scale to measure width of Fibre Optics LED. Supplied with AF/RF Generator 10HZ to 1MHz , Digital Fibre Optic power meter, Digital multimeter, Cathod Ray Oscilloscope 20MHz.		
72	Study of I-V Characteristics of DIAC	0-50V DC at 50mA regulated power supply, 45V AC at 50mA unregulated power supply, DC voltmeter of 200mA and 50mA, DIAC, Supplied with Cathod Ray Oscilloscope		
73	Study of I-V Characteristics of a TRIAC	0-70V DC at 100mA regulated power supply, 0-3V DC at 30mA regulated power supply, 55V at 100mA fixed AC supply, 7V at 30mA fixed AC supply, DC Ammeter 10mA & 100mA, DC Ammeter 0-30mA, DC voltmeter ranges 5V and 100V, TRIAC, Three potentiometers Supplied with Cathod Ray Oscilloscope		
74	Study of I-V Characteristics of a SCR	0 – 50DC at 50mA continuously variable power supply, 0 – 3V DC at 50mA continuously variable power supply, 0-10V AC at 50Hz variable power supply for Anode, DC voltmeter ranges 1V & 50V, DC milliammeter range 0-50mA, Silicon Controlled Rectifier, Fixed limiting resistances		

		Supplied with Vacuum Tube Voltmeter and Cathod Ray Oscilloscope 20MHz		
75	SCR as a half wave and full wave rectifiers with R & RL loads	SCR as a half wave and full wave rectifiers with R & RL loads		
76	DC motor control using SCR	DC motor control using SCR		
77	Study of parallel and bridge inverter	SCR Parallel Inverter Single Phase Transistorised Bridge Inverter		
78	Design of snubber circuit	Design of snubber circuit		
79	VI characteristics of MOSFET and IGBT	Characteristics of MOS-FET Characteristics of IGBT		
80	Study of Chopper circuit	Study of Chopper circuit		
81	To study position control of DC motor To study speed control of DC Motor	Effect of loading on the speed of the motor in the open loop and close loop Steady state error variation with forward gain in the open loop and close loop System time constant variation with forward gain in the open loop and close loop Effect of forward gain on disturbance rejection in the open loop and close loop Determination of Motor transfer function and tachometer characteristics in the open loop and close loop		
82	Verification of Thevenin's theorem Verification of Super Position theorem Verification of Maximum Power Transfer theorem	0-30V DC at 100mA continuously variable IC regulated power supply, +9V DC at 100mA IC regulated power supply, +5V DC at 100mA IC regulated power supply, DC Voltmeter of ranges 0.5, 1.5, 25 & 50V, DC Ammeter of ranges 0.05, 0.5, 5, 50 & 100mA.		
83	Half Wave Rectifier without and with shunt capacitance filter Centre tapped Full Wave Rectifier wit out and with shunt capacitance filter	Mains transformer, secondary center tap 100-0-100V at 100mA, DC Milliammeter to read 0-100mA, DC Voltmeter to read 0-300V, Four junction diodes, Filter choke, Supplied with AC Millivoltmeter		
84	Zenor diode as voltage regulator –load regulation	+/- 12V DC +/- 10% at 50mA unregulated DC voltage, DC Voltmetyer to read 0-15V, DC Milliammeter to read 0-50mA, NPN Transistor , Three Zenor diodes.		
85	Transistor characteristics in CE mode	Characteristics of Common Emitter configuration, Common Base configuration, Common Collector configuration, Transfer Characteristics of transistors. Two 0-10V DC at 50mA continuously variable power supply for Base emitter and collector emitter junctions. Two DC Ammeter of range 200mA and 10mA, Two DC voltmeters of ranges 1V and 10V. Two Silicon (NPN & PNP) transistors and two Germanium (NPN & PNP) transistors.		
86	Design and study of voltage divider biasing	Study of Q-point variation due to transistor replacement (changes in b) in Fixed –bias circuit Collector to base bias circuit Self bias (Emitter bias) circuit		

		Self bias in addition to voltage divider bias circuit.		
87	Designing of an CE based amplifier of given gain	Study of Common Emitter (CE) transistor amplifier circuit and evaluation of its input & output resistance, voltage gain, current gain and power gain. Study of Common Base (CB) transistor amplifier circuit and evaluation of its input & output resistance, voltage gain, current gain and power gain. Study of Common Collector (CC) transistor amplifier circuit and evaluation of its input & output resistance, voltage gain, current gain and power gain. Supplied with AC Millivoltmeter and Cathod Ray Oscilloscope CRO 20MHz		
88	To study and verify the characteristics of basic logic gates.	Verification of AND/NAND functions Verification of OR function Study of Function $F=A, (B+C)$ Study of Coincidence function $=A, B+$ Study of Majority Logic $F=ABC+AC=AB+BC$ Study of exclusive OR , Study of Half Adder Study of Full Adder, Study of Even Parity Check Study of Odd parity check , Study of Set-Reset Flip-Flop Study of D Flip-Flop , Study of J-K Flip-flop Study of Master Slave J-K Flip-flop, Study of Type T Flip-flop		
89	To verify and design AND,OR NOT, and XOR gates using NAND gates	To study the OR, AND & NAND logic gates and to verify the truth table To make various logic functions (OR, NOR,NOT,AND & EX-OR gates) by using NAND gates and verify their truth tables.		
90	Design a Half & Full adder Design a Half and Full subtractor	To study the Half Adder & Subtractor and Full Adder & Subtractor		
91	Design a 8 x 1 Multiplexer using gates	Digital Multiplexer (8-Bit) + 5V DC at 50mA Ic regulated power supply, Multiplexer IC 74151, LEDs for visual indication of status, SPDT switches for Logic Selection.		
92	To build a flip-flop circuits using elementary gates ( RS, CLOCKED RS, D-TYPE)	To construct the following Flip-Flops and study their characteristics RS Flip-Flop without clock RS Flip-Flop with clock D Flip-Flop		

## DEPARTMENT OF PHYSICS

Sl. No.	Name of the Equipment/ Apparatus	Minimum Required Specifications	Compliance (Yes/No)	Deviations
1	To Study Surface Tension by Capillary Rise Method	Apparatus for measuring surface tension including: A fine motion adjustable stand whose height can be increased or decreased slowly. A beaker can be put over it. Three capillary tubes of different diameter & a pin fixed on an adjustable clamp and stand. Supplied with Travelling Microscope of objective 7.5cm focusing di stance from object 10X Ramsden Eyepiece with cross wire is provided, Beaker and Thermometer		

2	To determine the height of a building using a sextant	Sextant Stainless scale is divided in 130 degree with a micrometer overhead vernier. Readings are taken to 12 seconds without a magnifier. With one erecting telescope, sight tube, filter and sun glasses. Stand for Sextant 120 cm high with leveling screw.		
3	To study the motion of Spring and calculate (a) Spring Constant, (b) g and (c) Modulus of Rigidity.			
4	To determine Moment of Inertia of a Flywheel.	Flywheel about 20cm dia, by 45mm wide turned and carefully balanced and mounted on horizontal shaft held in ball bearings. The wheel is marked & a pointer is fixed to the bracket having four holes can be fixed to the wall also fitted with a five digit revolution counter. Supplied with Digital Stop Clock, Vernier Calliper and Slotted weights with hanger.		
5	To Determine Coefficient of Viscosity of water by Capillary Flow method ( Poiseuilles method)			
6	To determine Modulus of Rigidity of a Wire by Maxwell's Needle.	Maxwell's Needle consist of a hollow cylindrical brass tube of length 40cm suspended by a wire whose modulus of rigidity is to be determined. The hollow cylinder filled with four brass cylinders two solid and two hollow, each having 10 cm length and same radius. It is fitted with wire chuck and mirror. Supplied with Digital Stop clock and Laser light pointer.		
7	To determine the value of g using Bar Pendulum.			
8	To determine the value of g using Katers Pendulum.			
9	To study the characteristics of a Series RC Circuit			
10	To determine an unknown Low Resistance using Potentiometer	Comparison of Two small Resistances by using a Potentiometer Potentiometer 10 wiresxfitted with pulleys, Resistance 5ohms/10W and 6 ohms/10W, Galvanometer 30-0-30G, Six way key, Two 0-5V DC at 500mA variable regulated and short circuit protected battery eliminators.		
11	To determine an unknown Low Resistance using Carey Fosters Bridge.	Determination of Specific Resistance of a material and difference between two small resistances using Carey Foster's Bridge Carey Foster's Bridge four gape with sliding jockey, Galvanometer 30-0-30, 65mm round dial, Leclanche Cell, Resistance wire of two different gauges, Decade Resistance Box one dial in steps of 0.1 ohms, Single way plug key, Wire wound potentiometer with three terminals.		



12	To compare capacitances using De Sautys Bridge	To calculate the value of unknown capacitor ( 0.047uF – 1uF) in terms of capacitance. Inbuilt fixed DC regulated power supply, Inbuilt sine wave oscillator, In built 3 ½ Digit digital null detector. On board one decade dial, On board two set of two-decade dial, on board three-decade dial, on board four unknown capacitor.		
13	Measurement of Field Strength B and its variation in a solenoid (determined B/dx)			
14	To verify Thevenin's and Norton's theorems	Verification of Laws and Network theorems in DC circuit. To Verify Thevenin's Theorem , To verify Norton's Theorem, Verification of Ohm's Law, To verify Kirchoff's law, Verification of Series and Parallel laws, Verification of Superposition Theorem, Verification of Maximum power transfer theorem.		
15	To determine self-inductance of a coil by Andersons Bridge	Andersons Bridge Circuit with arms value, Potentiometer for varying one arm, Three different value inductances, Potentiometer with calibrated dial, Five capacitors selected by a band switch, Audio amplifier with its IC regulated power supply, One KHz Sine wave Oscillator with its IS regulated power supply, Speaker.		
16	To study response curve of a Series LCR Circuit and Parallel LCR Circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (C) Quality factor Q, (d) Band width.	Series and Parallel Resonance : Series resonance for different values of resistances, capacitances, inductances and plotting a resonance curve, Parallel for different values of resistances, capacitances, inductances and plotting a resonance curve, Measurement of Q for both series and parallele resonances, Measurement of dielectric constant relative permittivity of a liquid. Supplied with Audio frequency Generator, A.C Millivoltmeter and AF Millivoltmeter		
17	To determine the frequency of an electric tuning fork by Meldes Experiment.	Electrically maintained a large heavy nickel plated fork of approximately 60 vibrations, complete with electromagnetic relay fitted with silvered points of contact. Works on 4-8 volts battery current. The electromagnet is adjustable so that amplitude of vibration may be varied between wide limits. Stand with pulley, Light weight pan, Battery Eliminator and connecting wires.		
18	To plot the I-D curve and to determine the refractive index of a Prism.	Study of the variation of angle of deviation with the angle of incidence and to determine the refractive index of the material of the prism using (i-d) curve for a given wavelength using Spectrometer. Supplied with Spectrometer standard 6" dia circle reading 30 seconds, Mercury light source 80W with choke and wooden box, Prism 38 x 38mm , reading lens and spirit level.		
19	To determine refractive index of the material of a	Spectrometer standard 6" dia circle reading 30 seconds, Sodium light source 35 watts with vacuum jacket transformer and wooden box having 4 holes		

	prism using sodium source.	with slide covers, Prism 38 x 38mm , reading lens and spirit level.		
20	To determine the dispersive power and Cauchy constants of the material of a prism using mercury source.	Supplied with Spectrometer standard 6" dia circle reading 30 seconds, Mercury light source 80W with choke and wooden box, Prism 38 x 38mm , reading lens and spirit level.		
21	To determine wavelength of Sodium Light using Newton's Rings.	Supplied with Newton's Ring apparatus, Wooden reflector, Travelling Microscope Bridge type body, Sodium light source 35 watts with vacuum jacket transformer and wooden box having 4 holes with slide covers, Lens, and Spherometer.		
22	To determine the wavelength of (1) Na Source and (2) Spectral lines of Hg source using a plane diffraction grating	Spectrometer standard 6" dia circle reading 30 seconds, Diffraction grating Hilger & Watts type 15000 lines per inch, Sodium light source 35 watts with vacuum jacket transformer and wooden box having 4 holes with slide covers, Mercury light source 80W with choke and wooden box Prism 38 x 38mm, Reading lens and Spirit level 60/80mm length.		
23	To determine the dispersive power and resolving power of a plane diffraction grating.	Spectrometer standard 6" dia circle reading 30 seconds, Diffraction grating Hilger & Watts type 15000 lines per inch, Sodium light source 35 watts with vacuum jacket transformer and wooden box having 4 holes with slide covers, Mercury light source 80W with choke and wooden box Prism 38 x 38mm, (Slit) attachment for reading power of the telescope, Reading lens and Spirit level 60/80mm length.		
24	To determine the Mechanical Equivalent of Heat, J, by Callender and Barnes constant flow method	Callender and Barne's apparatus, Constant level bath with stand, Battery eliminator 2-12 V DC variable at 4 A, DC Ammeter 65mm round, DC Voltmeter 65mm round, Digital Stop Clock, Two thermometer 100°C x 1/10°C, Beaker, Rubber tubing.		
25	To determine the Coefficient of Thermal Conductivity of a bad conductor by Lee and Charltons disc method	Consists of cylindrical brass disc of 11.5 cm diameter and 12mm thick suspended by three strings from a ring held in a stand. A thin circular disc of the test material is placed between this slab and 5cm deep hollow cylinder brass vessel of the same diameter.		
26	To determine the Temperature Coefficient of Resistance by Platinum Resistance Thermometer (PRT)	Supplied with Callender and Griffith's Bridge, Platinum Resistance Thermometer, Galvanometer 30-0-30G 65mm round, Battery Eliminator 0-5V DC at 0.5A continuously variable.		
27	To study the variation of Thermo-emf of a thermocouple with difference temperature of its two junctions.	Study of different thermocouples and plot a graph between thermo emf and temperature of hot junction. Supplied with D.C Microvoltmeter, Different thermocouples, Retort stand, thermometer 0-360°C, Sand bath, Beaker, Funnel, Tripod stand, Test tube, Glycerin, Paraffin wax, wooden stand, UHF lead 12" with crocodile clip.		

28	To determine J by Calorimeter			
29	To determine the specific heat of liquid by the method of cooling	Supplied with Newtons Law of Cooling apparatus, consists of two units each having double walled joint less brass vessel, A copper colorimeter size of 7.5 x 5cm, Two thermometer 110°C x ½, Digital Stop clock.		
30	To Determine the Specific Heat of Solid by applying radiation of correction			
31	To study the V-I characteristics of a Zener Diode and its use as voltage regulator	<p>A. Diode and Zener Diode Characteristics 0-10V D.C at 10mA continuously variable power supply with low ripple &amp; hum and integral current limit resistor. D.C Voltmeter 65mm rectangular dial, range 1V and 10V D.C Microammeter 65mm rectangular dial, range 50mA and 10mA A Germanium semiconductor and a Zener Diode</p> <p>B. Zener Regulated power supply To study the standard zener diode voltage regulated power supply. To study the zener diode voltage regulated power supply having two zener diodes in series</p>		
32	To study of V-I and power curves of Solar Cells, and find maximum power point and efficiency.	<p>To study of the followings Illumination Characteristics, Current Voltage Characteristics, Power-load characteristics and Areal characteristics.</p> <ul style="list-style-type: none"> <li>Digital DC Ammeter dual range 3 ½ digit,</li> <li>Digital DC Voltmeter dual range 3 ½ digit,</li> <li>Digital DC Voltmeter 3 ½ Digit, nine different resistance values selected by a band switch, Solar Cell, Table Lamp and Five different area choppers.</li> </ul>		
33	To study the characteristics of a Bipolar Junction Transistor in CE configuration			
	To study the various biasing configuration of BJT for normal class A operation.			
34	To study the frequency response of voltage, gain of a RC-coupled transistor amplifier.	<p>Study of the overload characteristics of the amplifier Study the frequency response of the individual as well as the cascade amplifier Calculate the output and input impedance of the individual stages as well as that of cascade amplifier. Supplied with Decade Audio Frequency Generator, A.C. Millivoltmeter and Decade Resistance Box</p>		

35	To design a Wien bridge Oscillator for given frequency using an op-amp	To construct a Wein-Bridge Oscillator and determine the resistor ratio required to develop the correct degenerative feedback. To vary the value of resistance and capacitance in the lead leg network and to observe the resultant frequency changes. Supplied with Cathod ray oscilloscope 20 MHz and Digital frequency counter		
36	To design a Phase Shift Oscillator of given specification using BJT			
37	To study the Colpitt's Oscillator			
38	To show the tunneling effect in tunnel diode using I-V characteristics			
39	To determine the wavelength of laser source using diffraction of single slit and Double slit	To determine the wavelength of the Laser using Grating To determine the Slit width Supplied with Optical Bench 100cm long, Diode Laser with power supply, Optical screen about 10cm x 10cm with graph, Double convex lens, Optical Single Slit and Double slit , Diffraction grating Hilger & Watts type 15000 lines per inch, Lens holder for diffraction grating.		
40	To determine Plank's Constant using LEDs of at least 4 different colour	0-5 V DC at 2mA continuously variable IS regulated power supply with 1K ten turn potentiometer for fine voltage control, Digital panel meter 3 ½ digit 20 V DC, Digital panel meter 3 ½ digit 2000mA DC, Four different colour LED's (Red, Yellow, Blue and Green)		
41	To determine the value of e/m by (a) Magnetic focusing or (b) Bar magnet	Supplied with Cathod Ray Tube, High Voltage power supply for C.R.T and DC volts for deflection of Electron Beam, Voltmeter to read voltage, Three wooden stands, Magnetometer, Bar Magnet and Centimeter scales, Wooden stands for CRT and magnet.		
42	Milikan's Oil Drop apparatus	To setup the Milikan's Oil Drop apparatus and determine the charge of an electron Consists of heavy stable triangular cast iron base that supports the main steel pillar on which lamp house, condenser, microscope and automizer system is mounted. Lamp house encloses a 12-volt SMD LED and a condenser lens to focus the bright light on the oil drops. It can be adjusted in the horizontal plain by a slow-motion screw. Condenser plates are made of brass mounted at the top of the central pillar. Top plates has a small hole through which sprayed oil drops enter into the condenser chamber, separated by a distance of approx. 6 to 7mm and also provided with terminals for power supply connections. Supplied with Power Supply.		
43	To measure (a) Voltage and (b) Time period of a			

	periodic waveform using CRO and to test a Diode and Transistor using a Millimeter			
44	Half Adder, Full Adder and 4-bit binary adder			
45	Half Adder, Full Adder and 4-bit binary adder			
46	Half Subtractor Full Subtractor, Adder-Subtractor using Full Adder I.C			
47	To measure the susceptibility of paramagnetic solution ( Quincks Tube method)	Supplied with Electromagnet: 7.5 kg at 10mm air gap, Pole pieces 50mm Diameter, Energizing coils – Two each a resistance of about 3.0 ohm. Constant current range: 0-4 Amp. Power supply, Load regulation: Better than 0.5%, Line regulation: Better than +/- 2% , Metering : 3 ½ Digit LED DPM Digital gauss meter: Operates on the principle of Hall effect in semiconductor, Travelling Microscope: T-Shape model with horizontal and vertical scales Quinck's tube with stand		
48	To measure the Magnetic Susceptibility of Solids			
49	To measure the Dielectric Constant of a dielectric materials with frequency	VHF Oscillator: 360 Mcs to 410 Mcs Lecher wire: Fitted on 1.75-meter bench Detector: Bulb type Condenser: parallel plate Wooden scale: one meter long		
50	To determine the Hall coefficient of a semiconductor sample	Hall Effect board: Digital meter to read Hall voltage (0-200mV) and probe current (0-20mA) selectable by switch. It also provides constant current power supply. Hall Probe: Germanium Single Crystal N or P type with 4 spring type pressure contact, Resistivity- 8-10 ohms.cm, Zero-field potential- < 1mV adjustable, Hall voltage- 25-35mV/10mA/KG Electromagnet: 7.5 kg at 10mm air gap, Pole pieces 50mm Diameter, Energizing coils – Two each a resistance of about 3.0 ohm. Constant current range: 0-4 Amp. Power supply, Load regulation: Better than 0.5%, Line regulation: Better than +/- 2% , Metering : 3 ½ Digit LED DPM Digital gauss meter: Operates on the principle of Hall effect in semiconductor, Hall probe stand wooden.		
51	To draw the BH curve of Fe using solenoid and to	To study coercivity of material (Nickel, Soft Iron and Hard Steel). To study saturation magnetization of material (Nickel,		

	determine the energy loss from Hysteresis.	Soft Iron and Hard Steel). To study Retentivity of materials (Nickel, Soft Iron and Hard Steel). +/- 12V DC at 100mA IC regulated power supply 10,22,35,50,65,75,90,105 & 120V AC power supply at 1.5 Amp 3 ½ digits digital panel meter to read magnetic field A Solenoid with former fitted on the platform for producing magnetic field. Two helical potentiometers to vary continuous Area ratio and De magnetization. Supplied with Cathod Ray Oscilloscope 20 MHz		
52	To measure the band gap of a given semiconductor by four-probe method	Probe arrangement, Germanium crystal, Oven maximum temp about 200 <sup>0</sup> C, four probe set ups, Constant current generator, Digital panel meter.		
53	To verify the law of Malus for plane polarized light	To verify the Malus Law (Cosine square law) for plane polarized light with a help of photo voltaic cell Supplied with Optical bench: two 100 cm long steel rods ½ inch dia , Halogen lamp with house, Double convex lens, Polarizer and Analyzer, Photo voltaic cell , Micrometer having 0-50mA range		
54	To determine the specific rotation of sugar solution using polarimeter	Supplied with Polarimeter fitted with imported lauent's half shade system, with stand 20cm long polarimeter tube of borosil glass with 360 <sup>0</sup> rotations. Sodium light source complete with sodium lamp 35watt, Transformer and wooden box having four holes with slide covers.		
55	To analyse elliptically polarized light by using Babinets Compensator	Supplied with Babinet Compensator for producing elliptical polarization with different major and minor axis and micrometer screw reads up to 0.001cm, Sodium light source with transformer and wooden box, Mercury light with chock and wooden box, Quarter wave plate mounted on a graduated circular scale 360 <sup>0</sup> with rod, Polaroid mounted on a graduated circular scale 360 <sup>0</sup> with rod and two square stands.		
56	To determine the refractive index of liquid by total reflection using Wollastons air-film			
57	To determine the refractive index of (1) glass and (2) liquid by total internal reflection using a Gaussian eye piece.	Determination of the Refractive Index of a Glass / Water with the help of a microscope. Supplied with Travelling Microscope with true achromatic objective with 7.5 cm focusing distance from object, 10x Ramsden Eyepiece with cross wire, Least count horizontal scale 0.001cm, Vertical scale 0.001cm, Glass slab and beaker		
58	To study the polarization of light by reflection and determine the polarizing angle for air –glass interface.	Supplied with Incandescent bulb with house, Double convex lens, Glass plate and mirror plate with arrangement for rotation and angle measurement, Polaroid mounted on a graduated circular scale 360 <sup>0</sup> and attached with Photo Voltaic Cell, Micrometer having 50mA range.		
59	To determine the Stefan's law of	To verify Stefan's Law of Radiation by using incandescent lamp.		

	radiation and to determine Stefans's constant	0-6 V DC at 2A power supply with coarse and fine voltage control, DC Voltmeter 65mm rectangular, DC current meter 65mm rectangular and Incandescent lamp.		
60		Determination of Stefan's Constant using Incandescent lamp and Photo Voltaic Cell Supplied with DC power supply 0-6 volt at 3A with coarse and fine voltage control, DC voltmeter 65mm rectangular, DC Milliammeter 65mm rectangular, F.E.T Voltmeter 65mm rectangular, Incandescent lamp, Photo Voltaic cell, Optical bench with two stands one for lamp house and other for photo voltaic cell.		
61	To determine Boltzmann constant using V-I characteristics of PN junction diode.			
62	To determine the Young's modulus Y of a wire by Searle's method			
63	To determine the modulus of rigidity of a wire by Maxwell's Needle.			
64	To determine the value of Y of a rubber by using travelling microscope			
65	To determine the Rigidity of modulus by static method			
66	To determine the frequency of A.C mains by using Sonometer	Supplied with Sonometer one meter long provided with wire of two different material steel and brass, Tuning Fork set of eight, Rubber pad, Step down transformer, Electromagnet, Serew gauge, Retort stand, Slotted weights $\frac{1}{2}$ kg set of 5, connecting wires.		
67	Verification of Laws of vibration of a string by using Sonometer	Same as above instrument		
68	Determination of E.C.E of a copper by taking 3 readings	Determination of E.C. of Copper using a copper voltameter Supplied with Copper voltmeter, Battery Eliminator 0-5 V DC at 3A continuously variable, D.C Ammeter 65mm round dial, Digital Stop Clock, Chemical Balance with weight box.		
69	Determination of Refractive Index of the material of a Prism using Sodium light	Supplied with Spectrometer standard 6" dia circle reading 30 seconds, Sodium light source 35 watts with vacuum jacket transformer and wooden box having 4 holes with slide covers, Prism 38 x 38mm, reading lens 40/50mm and spirit level 60/80 mm length.		
70	Determination of radius of curvature			

	of a Concave / Convex mirror by using Kohlrausch's method.			
71	To determine the magnifying power of a given telescope	Supplied with Telescope, Travelling Microscope with horizontal scale 20cm and vertical scale of 15cm with vernier constant 0.01mm. Slit with adjustable height, Incandescent lamp.		
72	Transistor characteristics NPN/PNP	Characteristics of Common Emitter configuration, Common Base configuration, Common Collector configuration, Transfer Characteristics of transistors. Two 0-10V DC at 50mA continuously variable power supply for Base emitter and collector emitter junctions. Two DC Ammeter 65mm rectangular dial 200mA and 10mA, Two DC voltmeters 65mm rectangular dial 1V and 10V. Two Silicon (NPN & PNP) transistors and two Germanium (NPN & PNP) transistors.		
73		Triode Valve Characteristics To obtain static and mutual characteristics of a given triode. To determine the Coefficients $g$ , $r$ , and $m$ of the triode valve from its characteristics.		
74	To determine the Reduction Factor of a Tangent Galvanometer	Supplied with Tangent Galvanometer having Bakelite ring of 6" dia with three windings of 2, 50 and 500 turns, Battery eliminator 0-5V DC at 3A continuously variable regulated and short circuit protected, D.C Ammeter 65mm dia, Reversing key and Spirit level.		
75	To study the variation of Magnetic Field along the axis of a circular coil carrying current.	Supplied with Magnetic Field demonstrator and power supply		
76	Experiments with Optical Bench Bi-Prism assembly with optical Bench			
77	Thickness of Thin Wire using Optical Bench	Supplied with Optical Bench two 150cm long steel rod $\frac{3}{4}$ " dia. Micrometer Eyepiece (Ramsden 10x), Optical Single Slit, Thin wire with stand, Sodium light source 35 watts with vacuum jacket transformer and wooden box having 4 holes with slide covers.		
78	Determination of Wavelength of Monochromatic source using Single Slit and Double Slit	Supplied with Optical Bench two 150cm long steel rod $\frac{3}{4}$ " dia. Micrometer Eyepiece (Ramsden 10x), Optical Single Slit & Double Slit, Straight Edge (Blade) with holder, Sodium light source 35 watts with vacuum jacket transformer and wooden box having 4 holes with slide covers.		
79	Michelson's Interferometer: Determination of $A$ and $\alpha$ , thickness of mica sheet	Optical Bread Board with support 800 x 600mm SS Kinematic laser mount +/- 4 degree Beamsplitter mount Mirror mount with Translation Mirror mount with precision Translation Rotation stage Screen with mount		



		Pressure cell Mirror with cell Beamsplitter Glass slide Diode Laser with power supply (Red) Diode Laser with power supply ( Green )		
80	Fabry Perot Interferometer (Projection Based & CCD Based)	Supplied with Optical Rail Length 1000mm Fabry Perot Interferometer Material N-BK7, Dia 25mm, R/T 60:40 Kinematic Laser Mount Plano Convex lens with mount Diffuser screen with measurement unit Diode Laser with power supply (Red) Diode Laser with power supply ( Green )		
81	Polarization Experiments: Quarter Wave plates, study of elliptical polarized light	Supplied with Optical Bench with six uprights (fixed)with holders, Incandescent bulb with house, convex lens 75mm dia 10FL, Analysing & Polarising Polaroids each mounted on a graduated circular scale 360 <sup>0</sup> , Quarter (1/4plate) wave plate, Photo voltaic cell mounted in a house, Microammeter having 25mA and 50mA ranges.		
82	Zeeman Effect	To perform qualitative observations of the Zeeman effect: Observing the line triplet for the transverse Zeeman Effect To perform quantitative measurements on the Zeeman Effect including To find Spacing of the etalon Verification of the magnetic moment constant Bohr magnetron ( $\mu$ ) Analysis of Plank's constant (h) and speed of light © using Zeeman Effect Calibration of the magnetic field.		
83	Babinet Quartz spectroscopy			
84	Determination of e/m by (i) Braun tube method (ii) Magnetron Valve method	Determination of e/m by (i) Braun tube method (ii) Magnetron Valve method  e/m by Braun tube method A cathode ray tube of 6cm dia type 7JI055N A Solenoid of proper dimensions Power supply unit voltage varied from 1200 to 1500 volts with a voltmeter to read the voltage Power supply to operate the solenoid Dc supply of 125 volts AC supply for the deflecting plates of the cathode ray tube.  e/m by Magnetron Valve method One board consisting A valve with 8 pin base fixed on panel, Regulated power supply 0-10V for plate voltage, Constant current source 0-2Amp for solenoid, Digital voltmeter 3 ½ digit having range 2Amp Dc for solenoid, Digital Milliammeter 3 /12 digit having range 2mA DC for plate current, u Solenoid for magnetic field.		

85	Determination of Planck's constant by photoelectric effect method	Rail based platform 500mm Filter wheel with interference filters Dia 15mm, Wavelength 404, 450, 505,546 and 578nm Tungsten Halogen Lamp with mount 20W Photosensitive device with mount – vacuum photo tube Photo electric effect current unit 0-10V, Current- nano micro Amp.		
86	Measurement of velocity of light by Lecher wire			
87	G.M counter experiments: (i) characteristics of the Geiger tube (ii) Inverse square law			
88	Verification of Boolean Algebra	+5V DC at 100mA IC regulated power supply Four NOT gates Three, 3-input AND gates Three, 3-input OR gates Three switches for giving binary logic input states Two LEDs , driven by LED driver circuit for visual indication of output		
89	Verification of dual nature			
90	Characteristics of F.E.T	0 to 20V DC at 50mA continuously variable power supply 0 to 12V DC at 50mA continuously variable power supply Two DC voltmeters to read 0-20V DC Milliammeter to read 0-20mA Field effect transistor		
91	Determination of Hall constant of a sample and its identification	Hall effect control unit Current 0-10ma, Voltage- 0-200mV Sample control holder with rigid base Gauss probe holder with mount Digital Gauss meter 0-20 K Gauss Hall effect cartridge n & p type lightly doped Germanium (Ge) Electromagnet 5K Gauss ( at 20mm pole space) Constant current power supply 0-3.5 Amp		
92	Determination of energy gap by p-n junction method			
93	Study of dispersion relation of an electric analog of mono atomic linear chain			
94	Study of dispersion relation of an electric analog of diatomic linear chain			

**DEPARTMENT OF ZOOLOGY**

<b>Sl. No.</b>	<b>Name of the Equipment/Apparatus</b>	<b>Minimum Required Specifications</b>	<b>Compliance (Yes/No)</b>	<b>Deviations</b>
01	Cooling Centrifuge	Refrigerated Bench top Centrifuge. Temp- -11 °C to 40 °C Speed range -100 to 14,000 rpm (10 rpm steps) Maximum RCF -22,132 × g Capacity - 4 × 750 mL / 4 × 5 MTP		
02	ELISA reader	Wavelength accuracy – 2m, Micro plate type- 6 ~ 384 well plate Shaking- Two step speed DNA/RNA Micro Volume plate (NANO-V)- 24well / 2ul Sample (Option)		
03	Laminar flow ultraclean air unit	Nominal size- 1.6 meters (5feet) Work area Dimension (WxDxH)- 1600x630x600mm Window Open- 200mm HEPA filter Filtration Efficiency- HEPA(@0.3µm≥99.995%) Velocity- Down flow-≥0.30m/s		
04	Nano drop spectrophotometer lite	Wavelength range (nm) – 190 nm-1,100 nm, Photometric accuracy- +- 0.006A Compatibility with lab X software – Yes Corvette holder- yes		
05	Thermal cycler	Samples under test can be raised up to a temperature of 1200 Deg C with an accuracy of ±1% FS Samples under test can be raised up to a temperature of 1200 Deg C with an accuracy of ±1% FS, Furnace dwell time : 0-99 min min Heating platform size : 250 mm×250 mm, Recorder output- 5V		
06	PCR Gradient Thermal Cycler	Power supply- 85 -- 264VAC , 47 ~ 63Hz , 600 W LCD Display- Touch Screen, 8inch , 800x600 Pixels, TFT Display resolution- 0.1 "C Capacity- 48 x 0.2 ml +30 x 0.5 ml Dimension (L*W*H)- 380 X 240 x 260 mm		
07	Gel-Electrophoresis	No of memory stick- 1 Net quantity- 0.1 count,		
08	UV- visible Trans illuminator	Wavelength accuracy- 0.9 nm, Resolution - > 1.5 Finger print reader, barcode scanner, Lin set software, printer, cent rifer		
09	Cooling incubator	232 -323 L, Optimal protection control and capacity		

10	Orbital shaking incubator	fits flask 4 x 1L C/DC input 230 V AC 20-300 rpm shaking frequency 4-65 °C temp. range (Temperature Increments: 0.1 deg. C) external – W × D × H = 37 cm × 53 cm × 40 cm		
11	Vortex mixer	AC.DC INPUT- 230 V AC, Features- CE compliant Parameter -0-3400 rpm speed L ×W × H -14 cm × 16 cm × 13 cm  manufacturer/tradenCo		
12	MVX10 stereo microscope	Mono-zoom variable magnification system Zoom Range: 10:1 (0.63 X - 6.3 X) Zoom Ratio:1: 18 Field no- 22Tilting trinocular head that allows switching between standard and stereo observation		
14	Binocular Biological microscope	Eyepiece:WF10×/20mm Objective:4×, 10×, 40× (S), 100× (S, Oil) Stage:180mm×130mm Viewing Head: Seide top Binocular Head		
15	Digital Microscope	Cell Pad 8” Touch screen, high resolution ( 2592x 1944) color LCD. Built-in camera with 5.0 Megapixel resolution. Pre loaded capture & measurement software Working Distance- 100 mm, Zoom Range- Zoom 0.7X to 4.5X with magnification ratio of 16.4 Magnification range- 7x - 45X		
16	Laboratory hot air oven	<ul style="list-style-type: none"> <li>• Fan oven: Forced convection</li> <li>• Max temp: 400 - 600°C</li> <li>• Min temp: Ambient +60°C</li> </ul> Volume: 30 to 120 litres		
17	Industrial vertical Autoclave.	Product type- vertical Autoclave. Material- Stainless steel.		
18	Double distillation unit.	Distillation output capacity- 4 lt/hr Electrical Requirements - 230-250 volts Single phase 3.5x2 kw Quartz heater. Minimum cooling Water requirement- 2.5 Lit / min (Each) Biological activity- Progeny Free Conductivity S/cm- <1 x 10 <sup>6</sup> Distillate temp- 65- 75 <sup>0</sup> C		
19	Water bath shaker.	Type of product: Water bath shaker Capacity: 100ml x 12 flask Shaking speed range: 40-180 strokes per min		
20	pH meter (Digital)	Voltage range:10.0-600.0V, Current range:0.010-20.00A, Auto range		

21	Ultrasonic bath Sonicator.	Operating frequency 33 ±3 KHz, Frequency of 50 KHz, Digital Temperature Controller		
22	Dry bath	2 blocks, 5°C above ambient to 150°C temperature range, <30 minute heating time for 20 to 150°C, 99h 59m timer, 0.3°C temperature uniformity		
23	Magnetic Stirrer	<ul style="list-style-type: none"> <li>• Temperature range: Working plate: RT to 350 °C Liquid: RT to 250 °C.</li> <li>• Maximum stirring volume: 20 L.</li> <li>• Speed range: 50 to 2000 rpm.</li> </ul> <b>8.</b> Motor type : DC Brushless motor		
24	Weighing balance	Type- Electronics weight balance, Capacity - 1 Kg, Least count- 0.0001 Gm, ➤ Display Type- LCD		
25	Micropipette set	Range volume- 0.1 – 10000 micro litter. Multifunctional micropipette Motor- Linear stepping electronic piston control Memory- Saves up to 6 programs at a time, Tip Ejection- Manual Autoclavable lower part- 121° C, 20 mins, 1 bar		
26	Quick spin centrifuge	Maximum speed/RCF: 6,000 rpm/2,000 x g Maximum capacity: Strip tube rotor 2 x 0.2 mL strips; Standard tube rotor 6 x 1.5/2.0 mL Dimensions: (W x D x H): 5 in. (12.7 cm) x 5 in. (12.7 cm) x 4.4 in. (11.2 cm) Weight: 1 lb/ 0.45 k		
27	Rotary Microtome	<ul style="list-style-type: none"> <li>• Power supply- 220 V</li> <li>• Frequency -50 Hz</li> </ul> Thickness: 1-50 micron Knife length standard: 120mm Object feed & operation; Manual Max Specimen size: 32mm (Section)		
28	ICSI Micromanipulator for I.V.F	Measuring Stage- 150 x 150mm Observation table- Trinocular inclined at 30 Diameter- 8 mm Objectives- 2 x Eye Piece		
29	Digital Colorimeter	Frequency - 50/60Hz Temperature- 10 - 40 degree C		
30	Articulated Skeleton	Length - 170cms		
31	Auto Karl Fischer Titrimer	Capacity- 1 ml, Readability- 0.05 ml, Capacity- 0 to 100%, Dimension- 288X315X180mm (LXBXH)		

Yours faithfully,  
Authorized Signatory of the firm with Date and Seal

## FORM T 6: FINANCIAL TURNOVER DETAILS

Financial Turnover of the Organization during Last Three Financial Years (Certified by a Practicing Chartered Accountant)

Sl. No	Financial Year	Turnover in Rs
1	2019- 2020	
2	2020- 2021	
3	2021- 2022	

Average Annual Turnover for the last three years (INR)

Name of the C A Firm:

Firm Registration No.:

Name of the Chartered Accountant: Membership No.:

Signature with Seal:

Yours faithfully,

Authorized Signatory of the firm with Date and Seal

**FORM F 1: FINANCIAL PROPOSAL SUBMISSION FORM**

To,  
The Principal,  
Science College (Autonomous), Hinjilicut

Sub: Submission of Financial Proposal to select supplier for Supply of Laboratory Equipments/Apparatus at the college.

REF: RfP No: 11342302/OHEPEE/ 2022-23/11, Dated 16.11.2023

Dear Madam/Sir,

I, the undersigned, here by submitting the Financial Proposal to select supplier for “Supply of Laboratory Equipments/Apparatus” at the college in accordance of RfP No: 11342302/OHEPEE/ 2022-23/11, Dated 16.11.2023

I, hereby declare that all the financial figures mentioned the Financial Proposal is true and correct. I also accept that any misrepresentation of financial facts and figures may lead to disqualification of my proposal.

Sl. No	Name of the items/ Equipment	Company/ Make	Quantity	Unit rate in fig. (Rs.)	Total Rs.
1					
2					

(A)Total value: RS----- % of GST: ----- GST amount: Rs -----

**Note:**

- 1) Amount mentioned in “A” Total value will be considered for the financial Bid evaluation. Tax amount will not be considered for evaluation.
- 2) Unit Rate/Value must be quoted exclusive of any Tax and duties. Tax percentage and Tax amount should be mentioned separately. The price Bid will be evaluated as per total value of the Laboratory Equipments/Apparatus exclusive of Taxes and duties.

Yours faithfully,

Authorized Signatory of the firm with Date and Seal

## **SECTION-6**

(Certificate of willingness to be submitted by all firms)

To

The Principal

Science College (Autonomous), Hinjilicut

Sub: Submission of Willingness certificate for supply of Laboratory Equipments/Apparatus at our college premise.

Sir,

I am to inform you that my firm (name of the firm with address) is ready to Supply of Stools, throughout the State of Odisha within 15 days of receipt of work order from the colleges selected under OHEPEE, if my firm is elected as L1, bidder during selection of tender.

In the event of my firm's failure to supply and install the required items in the selected L1 cost, my EMD/Performance Security will be forfeited.

Yours faithfully,

Authorized Signatory of the firm with Date and Seal



**ANNEXURE-1**  
**(Proposal Submission Check List)**

<b>Sl. No</b>	<b>Description</b>	<b>Submitted (Yes/No)</b>
1	Earnest Money Deposit (EMD)	
2	Copy of Certificate of Incorporation / Registration	
3	Copy of Goods and Services Tax Identification Number	
4	Copy of PAN	
5	CA audited copies of Profit & Loss Account and Balance Sheet along with all schedules	
6	Copies of IT Returns for the last three financial years	
7	Technical Proposal Submission Form	
8	Organization's Details	
9	Experience Details	
10	Self-Declaration for not having been blacklisted	
11	Technical Specifications Compliance Sheet	
12	Financial Turnover Details	
13	Financial Proposal Submission Form	
14	Certificate of willingness to be submitted by all firms	