

**TENDER (E-PUBLISHING MODE)**  
**FOR**  
**SUPPLY & INSTALLATION OF EQUIPMENTS FOR PHYSICS LAB**  
**SCHOOL OF BASIC SCIENCES,**  
**AT IIT MANDI**



**Tender No.: IITMANDI/S&P/PUR-193/2015-16/8941-42**

**Tender date: 20<sup>th</sup> January, 2016**

**Last Date of submission: 15<sup>th</sup> February, 2016**

Indian Institute of Technology Mandi

Transit Campus: Mandav Hotel, 2<sup>nd</sup> Floor (Near Bus Stand), Mandi – 175001 (H.P)

**Tel.:** 01905-267062 **email:** [suman@iitmandi.ac.in](mailto:suman@iitmandi.ac.in)

Indian Institute of Technology Mandi, Mandi invites tender for supply, erection, installation, commissioning, testing, demonstration and training of **Physics Lab Equipments**, as per specifications given in the Annexure attached to the Tender form. All offers should be made in English and should be written in both figures and words. Tender forms can be downloaded from the website (<http://iitmandi.ac.in/administration/tenderseoi.html>) of the Institute. Tender document also published on e- tendering (<http://eprocure.gov.in/eprocure/app>). The bidder can also submit bids online.

The bidders are requested to read the tender document carefully and ensure compliance with all specifications/instructions herein. Non-compliance with specifications/instructions in this document may disqualify the bidders from the tender exercise. The Director, IIT Mandi, Kamand reserves the right to select the item (in single or multiple units) or to reject any quotation wholly or partly without assigning any reason. Incomplete tenders, amendments and additions to tender after opening or late tenders are liable to be ignored and rejected.

### **Terms and Conditions:**

1. The technical and financial bids should be quoted separately and put in different sealed envelopes marked “**Technical bid**” or “**Financial bid**” as applicable. These separate bids envelopes are to be put in an outer envelope which should also be sealed.
2. The Vendors who have earlier supplied the equipment to any of the IITs, IISc, IISERs and other Scientific Institute of National Repute may only tender. The details of such institutions and the cost with name of equipment may also be supplied with the bids.
3. The technical and financial bids should be submitted in original. The financial bid should include the cost of main equipment/item and its accessories. If there is any separate cost for installation etc. that should be quoted separately.
4. Each individual sealed envelope as well as the outer envelope should be marked with the following reference on the top left hand corner: “**IITMANDI/S&P/PUR-193/2015-16/8941-42/Item Name.\_\_\_\_\_dated 20<sup>th</sup> January, 2016**”
5. The printed literature and catalogue/brochure giving full technical details should be included with the technical bid to verify the specifications quoted in the tender. The bidders should submit copies of suitable documents in support of their reputation, credentials and past performance.
6. The rates should be quoted in figures (typed or printed) and cutting should be avoided. The final amount should be in figures as well as in words. If there are cuttings, they should be duly initialed, failing which the bids are liable to be rejected.
7. Any bids received after **1:00 P.M. on 15<sup>th</sup> February, 2016** shall not be considered
8. The Technical Bids will be opened on **15<sup>th</sup> February, 2016 at 03:00 P.M.** The date & time for opening of Financial Bids will be informed later on to the technically qualified bidders.
9. While sending rates, the firm shall give an undertaking to the effect that “*the terms/conditions mentioned in the enquiry letter/Tender Notice against which the rates are being given are acceptable to the firm.*” In case the firms do not give this undertaking, their rates will not be considered.
10. If the supplier/firm is original equipment manufacturer (OEM)/authorized dealer/sole distributor of any item, the certificate to this effect should be attached.

11. The quantity shown against the item is approximate and may vary as per demand of the Institute at the time of placing order.
12. All tender documents should have to be sent through courier, speed post or registered post only. All tender documents received after the specified date and time shall not be considered.

The postal address for submitting the tenders is:

**“Assistant Registrar, Stores and Purchase”  
Indian Institute of Technology Mandi (IIT Mandi),  
Administrative Block (Mandav Hotel,  
Near Bus Stand), Mandi – 175001 (H.P), India”**

13. In the event of any dispute or difference(s) between the vendee Institute (IIT Mandi) and the vendor(s) arising out of non-supply of material or supplies not found according to specifications or any other cause whatsoever relating to the supply or purchase order before or after the supply has been executed, shall be referred to “The Director, IIT Mandi”, Kamand who may decide the matter himself or may appoint arbitrator(s) under the arbitration and conciliation Act,1996. The decision of the arbitrator shall be final and binding on both the parties.
14. The place of arbitration and the language to be used in arbitral proceedings shall be decided by the arbitrator.
15. All disputes shall be subject to Mandi Jurisdiction only.
16. All tenders in which any of the prescribed conditions is not fulfilled or any condition is putforth by the tenderer shall be summarily rejected.
17. IIT Mandi reserves the right to cancel the tender at any point of time without assigning any reason.
18. The bidders or their authorized representatives may also be present during the opening of the Technical Bid, if they desire so, at their own expenses.

**Note:** Price bids of only those bidders will be opened whose technical bids are found suitable by the committee appointed for the purpose. Date and time of opening of price bids will be decided after technical bids have been evaluated by the committee. Information in this regard will be intimated to the technically qualified bidders. In exceptional situation, an authorized committee may negotiate price with the qualified bidder quoting the lowest price before awarding the contract.

#### 19. **Clarifications:**

In case the bidders requires any clarification regarding the tender documents, they are requested to contact our office (e-mail: [suman@iitmandi.ac.in](mailto:suman@iitmandi.ac.in) & [arsp@iitmandi.ac.in](mailto:arsp@iitmandi.ac.in) on or **before 02/02/2016**.

#### 20. **Tender Cost:**

A Demand draft of **Rs. 1,000/- (Rupees One Thousand only)** towards non-refundable **tender fee, drawn in favour of “The Registrar, IIT Mandi”** payable at Mandi should accompany the Technical bid documents. In the absence of tender cost, the tender will not be accepted.

## 21. **Earnest Money Deposit (EMD):**

A refundable amount of **Rs. 90,000/-** as earnest money deposit (EMD) in the shape of DD from a scheduled bank in India (**valid for a minimum period of 3 months from the date of submission of tender**) should accompany the bid documents. The DD drawn in favour of “The Registrar, IIT Mandi” payable at Mandi should accompany the bid documents. The EMD should be kept in a separate sealed envelope, should be marked clearly and put in the outer envelope that contains the technical and financial bid envelopes. The bidders should enclose a pre-receipted bill for the EMD to enable us to return the EMD of unsuccessful bidders. Failure to deposit **Earnest Money** will lead to rejection of tender. The bidders should submit separate EMD. In the event of the awardee bidder backing out, EMD of that bidder will be forfeited.

## 22. **EMD Exemption:**

- Bid Security (also known as Earnest Money) is to be obtained from the bidders except those who are registered with the Central Purchase Organisation, National Small Industries Corporation (NSIC) or the concerned Ministry or Department.
- Quotation submitted by Indian Agent in foreign currency on behalf of their principal or the foreign principal's quotation forwarded by the Indian Agent shall mandatorily submit tender cost along with EMD failing which their offer shall be out rightly rejected.

## 23. **Pre – Qualification Criteria:**

- a. Bidders should be the manufacturer / authorized dealer. Letter of Authorization from original equipment manufacturer (OEM) on the same and specific to the tender should be enclosed.
- b. The Vendors who have earlier supplied the equipment to any of the IITs, IISc, IISERs and other Scientific Institute of National Repute may only tender. The details of such institutions and the cost with name of equipment may also be supplied with the bids.
- c. An undertaking from the OEM is required stating that they would facilitate the bidder on a regular basis with technology/product updates and extend support for the warranty as well.
- d. OEM should be internationally reputed Branded Company.
- e. Non-compliance of tender terms, non-submission of required documents, lack of clarity of the specifications, contradiction between bidder specification and supporting documents etc. may lead to rejection of the bid.
- f. **Furnishing of wrong/ambiguous information in the compliance statement may lead to rejection of bid and further black listing of the bidder, if prima-facie it appears that the information in the compliance statement was given with a malafide/fraudulent intent.**

## 24. **Prices:**

- a. The Prices quoted should be inclusive of all taxes or duties, packing, forwarding, freight, insurance, delivery and commissioning etc. at destination site (IIT Mandi,

Mandi/Kamand). IIT Mandi is registered with DSIR, Govt. of India and is exempted from Custom / Excise Duty. Exemption Certificate to this effect will be issued by IIT Mandi. **Hence, Customs/Excise Duty exempted price should be quoted.** The rates shall be firm and final. Nothing extra shall be paid on any account. **In the price bid/financial bid, the vendor should clearly mention the final price breakup i.e. ex-work price/FCA price, FOB price, CIP/CIF price & FOR IIT Mandi, Kamand Campus price, as applicable in their bid.**

- b. In case of imported equipment(s)/item(s), the agency commission, if any, payable in Indian rupees should be mentioned separately. For imported equipment, the Letter of Credit will be opened for the amount excluding agency commission in Indian Rupees. The firm should clearly mention the address of foreign bank in the financial bid.

**25. Validity:**

The bid should be valid for acceptance up to a period of 180 Days. The Bidders should be ready to extend the validity, if required without any additional financial implications.

**26. Delivery:**

The Equipment should be delivered and installed within the period as specified in the purchase order and be ready for use within 24 weeks of the issue of purchase order unless otherwise prescribed. If the bidder fails to deliver and place any or all the Equipments or perform the service by the specified date, penalty at the rate of 1% per week of the total order value subject to the maximum of 10% of total order value will be deducted.

**27. Training:**

Bidders need to provide adequate training to the nominated persons of IIT Mandi at their cost. IIT Mandi will not bear any training expenditure.

**28. Warranty Declaration:**

Bidders must give the comprehensive on-site warranty as required from the date of successful installation of Equipment against any manufacturing defects and also give the warranty declaration that *“everything to be supplied by us hereunder shall be free from all defects and faults in material, workmanship and shall be of the highest quality and material of the type ordered, shall be in full conformity with the specification and shall be complete enough to carry out the experiments, as specified in the tender document.*

Any deviation in the material, and the specifications from the accepted terms may liable to be rejected and the bidders need to supply all the goods in the specified form to the satisfaction / specifications specified in the order / contract and demonstrate at their own cost.

- 29. Performance Bank Guarantee:** A performance bank guarantee from a scheduled bank in India for an amount equal to 10% of the price for duration of two months beyond the expiry of warranty period will be taken from the supplier or Indian agent.

30. **Terms of Payment:** Payment will generally be made only after delivery and satisfactory installation, testing, commissioning etc. **This must be specified in the tender/quotation.**

- In case of imported supplies, payment (excluding Indian agency commission, if any) will be made through irrecoverable Letter of Credit in two installments. 80 % of the money will be released on submission of shipping of documents. Remaining 20 % will be released after successful installation of the instrument and submission of a performance bank guarantee for 10% of the order value from a nationalized bank, valid for 2 months beyond the expiry of the warranty.
- In case of required item quoted in INR, 100% payment will be made through wire transfer after receipt of material in good condition and successful installation of the instrument and on submission of a performance bank guarantee for 10% of the order value from a nationalized bank, valid for 2 months beyond the expiry of the warranty.

31. **Tender expenses and documents:** All costs incurred by the bidder in the preparation of the tender shall be at the entire expense of the bidder.

32. **Tender Evaluation Criteria:** The technical bids will be opened and evaluated by a duly constituted committee. After evaluation of the technical bid, the financial bid for only those offers which have qualified in the evaluation of technical bid will be opened.

33. **Return of EMD:**

- The earnest money of unsuccessful bidders will be returned to them without any interest within 15 working days after awarding the contract.
- The earnest money of the successful bidder will be returned to them without any interest within 15 Days after supply of material.

34. **Manual and documentation:** All the manuals necessary for operating and servicing the equipment (including details of electronic circuits) will have to be provided along with the instrument.

35. The IIT Mandi reserves the right to cancel the tender at any stage (point of time) without assigning any reason.

36. Bidders should go through the tender terms, conditions and specifications carefully and fill in the attached compliance statement accurately and unambiguously. They should ensure that all the required documents are furnished along with the bid.

Sd/-  
**Assistant Registrar  
Stores & Purchase**

## BID PARTICULARS

1. Name of the Supplier :

2. Address of the Supplier :

3. Availability of demonstration of equipment : Yes / No

4. Tender cost enclosed: : Yes/No if yes

D.D. No. \_\_\_\_\_ Bank \_\_\_\_\_ Amount \_\_\_\_\_

5. EMD enclosed : Yes / No if Yes

D.D. No. \_\_\_\_\_ Bank \_\_\_\_\_

6. Name and address of the Officer/contact person to whom all references shall be made regarding this tender enquiry.

Name :

Address :

Telephone No. :

Fax No. :

Mobile No :

e-Mail :

Web :

**Ref:-ENQUIRYNO:-IITMANDI/S&P/PUR-193/2015-16/Physics Lab Equipments**

**Item No. 1: Fourier optics - 2f arrangement**

Complete experimental set up to investigate Fourier optics with a 2f-arrangement including:

- He-Ne-Laser: power  $\geq 5\text{mW}$ ; wave length- 632.8 nm; modes- TEM00; degree of polarisation 1:500 or better; beam divergence 1 mrad or less; max. power drift: 2.5% /8h.
- Laser power supply: high voltage power supply for HeNe-Laser with programmable timer for selection of exposure time between 0.1 ... 99 s and controllable shutter, digital display for preset shutter times as well as those which have already occurred.
- Optical base plate: for setting up magnetically adhering optical components. Rigid and vibration-damped working base made of steel plate; with corrosion protection and imprinted grid (5 cm  $\times$  5 cm); three fixed adapter sleeves for laser and laser shutter; with rubber feet for non-slip working; base plate size (mm): 590  $\times$  430  $\times$  24.
- Optical components: Lenses; Diffraction grating, Screen; Surface mirrors; Pinholes etc.

**All necessary optics, connecting cables, support material, other auxiliary material and teachware to perform the experiment should be included.**

**Item No. 2: Fabry-Perot interferometer**

Complete experimental set up to investigate the multibeam interference of a laser light using a Fabry-Perot interferometer for the determination of the wavelength of light. The set up should include:

- He-Ne-Laser: power  $\geq 5\text{mW}$ ; wave length- 632.8 nm; modes- TEM00; degree of polarisation 1:500 or better; beam divergence 1 mrad or less; max. power drift: 2.5% /8h.
- Laser power supply: high voltage power supply for HeNe-Laser with programmable timer for selection of exposure time between 0.1 ... 99 s and controllable shutter, digital display for preset shutter times as well as those which have already occurred.
- Optical base plate: for setting up magnetically adhering optical components. Rigid and vibration-damped working base made of steel plate; with corrosion protection and imprinted grid (5 cm  $\times$  5 cm); three fixed adapter sleeves for laser and laser shutter; with rubber feet for non-slip working; base plate size (mm): 590  $\times$  430  $\times$  24.
- Interferometer plate: for precise and reproducible linear shift of optical components; shift path: max. 0.25 mm; resolution: 500 nm.
- Optical components: Lens, surface mirror, beam splitter, screen etc.

**All necessary optics, connecting cables, support material, other auxiliary material and teachware to perform the experiment should be included.**



### Item No. 3: Dispersion and resolving power of a prism and a grating spectroscope

Complete experimental set up to determine the refractive indices of liquids, crown glass and flint glass as a function of the wave length by refraction of light through the prism at minimum deviation. The set up should include:

- Spectrometer/Goniometer: with double Vernier, illumination device, telescope, prism table with prism support, magnifying glasses with scale (3 axes), fine tuning of length and width of slit; all turnable components with blocking device; graduation of disc:  $0\text{...}360^\circ$ , division  $0.5^\circ$ ; adjustment:  $1'$  (with vernier); resolution:  $0.2^\circ$ . Including flint glass prism.
- Spectral lamp Hg: for generation of line spectra; inner bulb: Quartz lamp; Luminance: at least  $50\text{ cd/cm}^2$ .
- Power supply for spectral lamps: voltage without load: 230V; burning voltage: 15...60V
- Lamp holder for spectral lamps: fixed connecting cable ; metal cover with outlet aperture.
- Optical components: Prism (crown glass). Hollow prism (equilateral prism made of optical glass with ground orifice and Teflon plug).  
Diffraction gratings (with  $\sim 4, 8, 10, 50, 600$  lines/mm in slide mount)

**All necessary connecting cables, support material, other auxiliary material and teachware to perform the experiment should be included.**

### Item No. 4: Michelson interferometer with optical base plate

Complete experimental set up according to Michelson to determine the wavelength of a laser light. The complete set up should include:

- Michelson Interferometer: compact, ready-to-use Michelson interferometer to measure light wavelengths and refractive index of liquids and gases; two mirrors and a beam splitter on metal plate; mirror displacement with  $\sim 0.001$  mm resolution, using a micrometer screw and a 1:10-lever; fine adjustment for tilt adjustment of the fixed mirror; holder for additional cell for investigation of gases and liquids; protective cover and two support rods.
- Optical base plate: for setting up magnetically adhering optical components. Rigid and vibration-damped working base made of steel plate; three fixed adapter sleeves for laser and laser shutter; with rubber feet for non-slip working.
- He-Ne-Laser: power  $\geq 5\text{ mW}$ ; wave length- 632.8 nm; modes- TEM<sub>00</sub>; degree of polarisation 1:500 or better; beam divergence 1 mrad or less; max. power drift: 2.5% /8h.
- Laser power supply: high voltage power supply for HeNe-Laser with programmable timer for selection of exposure time between 0.1 ... 99 s and controllable shutter, digital display for preset shutter times as well as those which have already occurred.
- Optical components: magnetic feet and adjusting support for optical base plate; pin hole; screen, white; surface mirror; horizontal sliding device; x-y-shifting device; achromatic objective.

**All necessary connecting cables, support material, other auxiliary material and teachware to perform the experiment should be included.**

**Item No. 5: Zeeman effect measuring set up**

The complete set up with electromagnet, camera and measurement software to investigate the normal and anomalous Zeeman effect and to determine Bohr's magneton. The set up should include:

- Light source preferable Cadmium lamp with suitable power supply.
- Fabry-Perot interferometer: mounted in metal tube on stem with other accessories.
- Camera: 1/4-inch digital camera to be placed on microscope eyepieces; images should be taken and analyzed with software; macrolens for use as video camera and other accessories.
- Variable Transformer.
- Electromagnet: without pole shoes together with differently shaped pole pieces; U-shaped iron core with coils; clamping system with threaded drive for sensitive air gap adjustment with suitable pole piece.
- Pole pieces: conical pole pieces, drilled, with mounted flange.
- Optical bench and accessories: to hold all necessary components.
- Polarization specimen:  $\lambda/4$  plate at 550 nm; made of mica.
- Rotary table: for heavy loads; metal base plate with tilt adjustable feet and bearing mounted metal top plate.
- Capacitor: electrolytic capacitor in cylindrical metal case.

**All necessary parts including connecting cables, support material, other auxiliary material and teachware to perform the experiment should be included.**

(PC is not required.)

**Item No. 6: Franck-Hertz experiment with the following specifications:**

Complete experimental set up to determine the excitation energy of Neon by accelerating electrons in a Neon-filled glass tube and measuring the electron current in dependence with applied voltage. The set up should include:

- Neon tube: Tetrode in Neon-filled glass tube stable housing with viewing window and connection to operating unit for recording the Franck-Hertz curve with up to at least 5 excitations and direct observation of light emission in the visible range.
- Control Unit: compact operating unit for Franck-Hertz experiment to be used with Hg- or Ne-tubes with automatic detection of tube type and automatic limitation of tube parameter. Examination by direct reading of displayed values, xyt-recorder, oscilloscope or PC.
- Data acquisition and analysis software: operating unit to be identified by the software automatically, presettings for given experiment; multi-user license.

**All necessary connecting cables, support material, other auxiliary material and teachware to perform the experiment should be included.**

(PC is not required.)

### Item No. 7: Hall effect with p-Germanium with interface

Complete experimental set up to measure the resistivity and Hall voltage of a rectangular germanium sample as a function of temperature and magnetic field. The complete set up should include:

- Hall effect module: an appropriate module to hold and supply carrier boards for the Hall effect experiment.
- Hall effect carrier board, p-Ge: for determination of temperature dependent Hall voltage and conductivity of doped semiconductors in connection with Hall effect module.
- Computer interface: for measurement and control of experiments.
- Interface sensor unit magnetic fields: plug-in module for a precise measurement of magnetic DC and AC fields. Readily calibrated; Multiple measuring ranges up to  $\pm 1$  T; max. resolution at least  $5 \mu\text{T}$ ; compensation  $\pm 1$  T in all measuring ranges.
- Magnetic field probe: tangential hall sensor for measuring magnetic flux densities in combination with a Teslameter or interface system. Material: GaAs, monocrystalline.
- Software for Hall effect: for measuring all relevant quantities of the hall experiment, i.e. Hall-voltage, current, voltage, magnetic field and temperature; compatible with interface and sensor unit; automatic recognition of connected sensor.
- Power supply: high performance, stabilized low voltage source; short-circuit proof DC voltage output; can be operated both as an electronically regulated DC source and as a regulated constant current source; all voltages are galvanically separated from the mains and are within the low voltage protection range. Output voltage: ripple max. 1 mV.
- Coil: pair of coils with on shock-resistant frame with safety plugs.
- Iron core: U-shaped, laminated, iron core made out of low loss soft iron dynamo plates, riveted.
- Pole pieces: Plane pair of pole pieces, especially suited to generate a homogeneous magnetic field (e.g. for Hall effect carrier boards) for attaching on iron core
- Digital Multimeter: To perform the necessary functions.

**All necessary connecting cables, support material, other auxiliary material and teachware to perform the experiment should be included.**

(PC not required)

## **Annexure E**

### **Item No. 8.: Ultrasonic diffraction at different single and double slit systems with the following specifications:**

Complete experimental set up to record the intensity of the diffracted and interfering partial ultrasonic waves at single slits of various widths as well as various double slits using a motordriven goniometer system. The set-up should include:

- Step motor-driven goniometer with adjustable fixation bar for ultrasonic transmitter, mirror and ultrasonic receiver, with a beam length of at least 550 mm, measurement range of at least 120 degrees, angle solution of less than 0.15 degrees, diameter of at least 250 mm, circular experimentation plate to position diffraction objects in the center of rotation of the goniometer beam
- Reflecting mirror
- Object holder and diffraction objects
- Ultrasonic transmitter and receiver
- Goniometer operation unit for manual, programmable and PC operation, with LED to display angles, velocity and step width
- Software to drive goniometer and for data acquisition and analysis

**All connecting cables, support material, other auxiliary material and teachware to perform the experiment are to be included.**

(PC not required)

**Installation and Training: -on-site installation and demonstration of the instruments  
- training to get hand-on experience with the instruments**

## Compliance statement for the tender specifications

**INDIAN INSTITUTE OF TECHNOLOGY MANDI  
HIMACHAL PRADESH-175001**

**Ref:-ENQUIRYNO:-IITMANDI/S&P/PUR-193/2015-16/ Physics Lab Equipments**

**Instructions:**

1. You have to fill in all columns and ensure that you furnish all the required information accurately and unambiguously.
2. If our specification contains any values, you have to provide your values against the column in the same unit as we have specified.
3. Deviation in values, materials etc. from our specification may be explained in the remarks column

Sr. No	Check list of documents/ Undertakings ?	YES/NO	Remarks (Give explanation if answer is No)
1.	Is Tender fees attached?		
2.	Is EMD attached? (if applicable)		
3.	Is the bidder original equipment manufacturer (OEM)/authorised dealer?		
4.	If authorised dealer, recent dated certificate to this effect from OEM, attached or not?		
5.	Undertaking from OEM regarding technical support & extended warranty present		
6.	Validity of 180 days or not?		
7.	Undertaking from bidder regarding acceptance of tender terms & conditions		
8.	Attach user list of quoted model only, with complete contact details.		
9	Whether list of reputed users (along with telephone numbers of contact persons) for the past three years specific to the instrument attached.		
10.	Whether special educational discount for Indian Institute of Technology (IIT) Mandi (H.P) given.		
11.	Whether required weeks training of operator and research students without any charges offered.		
	<b>Technical Specifications</b>		
12.	<b>Item No. 1 : Fourier optics - 2f arrangement:</b> Complete experimental set up to investigate Fourier optics with a 2f-arrangement including		
a.	He-Ne-Laser: power $\geq$ 5mW; wave length- 632.8 nm; modes- TEM00; degree of polarisation 1:500 or better; beam divergence 1 mrad or less; max. power drift: 2.5% /8h.		
b.	Laser power supply: high voltage power supply for HeNe-Laser with programmable timer for selection of		

	exposure time between 0.1 ... 99 s and controllable shutter, digital display for preset shutter times as well as those which have already occurred		
c.	Optical base plate: for setting up magnetically adhering optical components. Rigid and vibration-damped working base made of steel plate; with corrosion protection and imprinted grid (5 cm × 5 cm); three fixed adapter sleeves for laser and laser shutter; with rubber feet for non-slip working; base plate size (mm): 590 × 430 × 24.		
d.	Optical components: Lenses; Diffraction grating, Screen; Surface mirrors; Pinholes etc.		
13.	<b>Item No. 2 : Fabry-Perot interferometer:</b> Complete experimental set up to investigate the multibeam interference of a laser light using a Fabry-Perot interferometer for the determination of the wavelength of light. The set up should include		
a.	He-Ne-Laser: power $\geq 5\text{mW}$ ; wave length- 632.8 nm; modes- TEM00; degree of polarisation 1:500 or better; beam divergence 1 mrad or less; max. power drift: 2.5% /8h.		
b.	Laser power supply: high voltage power supply for HeNe-Laser with programmable timer for selection of exposure time between 0.1 ... 99 s and controllable shutter, digital display for preset shutter times as well as those which have already occurred		
c.	Optical base plate: for setting up magnetically adhering optical components. Rigid and vibration-damped working base made of steel plate; with corrosion protection and imprinted grid (5 cm × 5 cm); three fixed adapter sleeves for laser and laser shutter; with rubber feet for non-slip working; base plate size (mm): 590 × 430 × 24.		
d.	Interferometer plate: for precise and reproducible linear shift of optical components; shift path: max. 0.25 mm; resolution: 500 nm.		
e.	Optical components: Lens, surface mirror, beam splitter, screen etc		
14.	<b>Item No. 3: Dispersion and resolving power of a prism and a grating spectroscope:</b> Complete experimental set up to determine the refractive indices of liquids, crown glass and flint glass as a function of the wave length by refraction of light through the prism at minimum deviation. The set up should include		
a.	Spectrometer/Goniometer: with double Vernier, illumination device, telescope, prism table with prism support, magnifying glasses with scale (3 axes), fine tuning of length and width of slit; all turnable components with blocking device; graduation of disc: 0...360°, division 0.5°; adjustment: 1' (with vernier); resolution: 0.2°. Including flint glass prism.		

b.	Spectral lamp Hg: for generation of line spectra; inner bulb: Quartz lamp; Luminance: at least 50 cd/cm <sup>2</sup> .		
c.	Power supply for spectral lamps: voltage without load: 230V; burning voltage: 15...60V		
d.	Lamp holder for spectral lamps: fixed connecting cable ; metal cover with outlet aperture.		
e.	Optical components: Prism (crown glass). Hollow prism (equilateral prism made of optical glass with ground orifice and Teflon plug). Diffraction gratings (with ~ 4, 8, 10, 50, 600 lines/mm in slide mount)		
15.	<b>Item No. 4: Michelson interferometer with optical base plate:</b> Complete experimental set up according to Michelson to determine the wavelength of a laser light. The complete set up should include:		
a.	Michelson Interferometer: compact, ready-to-use Michelson interferometer to measure light wavelengths and refractive index of liquids and gases; two mirrors and a beam splitter on metal plate; mirror displacement with ~ 0.001 mm resolution, using a micrometer screw and a 1:10-lever; fine adjustment for tilt adjustment of the fixed mirror; holder for additional cell for investigation of gases and liquids; protective cover and two support rods.		
b.	Optical base plate: for setting up magnetically adhering optical components. Rigid and vibration-damped working base made of steel plate; three fixed adapter sleeves for laser and laser shutter; with rubber feet for non-slip working.		
c.	He-Ne-Laser: power $\geq 5\text{mW}$ ; wave length- 632.8 nm; modes- TEM <sub>00</sub> ; degree of polarisation 1:500 or better; beam divergence 1 mrad or less; max. power drift: 2.5% /8h.		
d.	Laser power supply: high voltage power supply for HeNe-Laser with programmable timer for selection of exposure time between 0.1 ... 99 s and controllable shutter, digital display for preset shutter times as well as those which have already occurred.		
e.	Optical components: magnetic feet and adjusting support for optical base plate; pin hole; screen, white; surface mirror; horizontal sliding device; x-y-shifting device; achromatic objective.		
16.	<b>Item No. 5 :Zeeman effect measuring set up:</b> The complete set up with electromagnet, camera and measurement software to investigate the normal and anomalous Zeeman effect and to determine Bohr's magneton. The set up should include:		
a.	Light source preferable Cadmium lamp with suitable		

	power supply.		
b.	Fabry-Perot interferometer: mounted in metal tube on stem with other accessories.		
c.	Camera: 1/4-inch digital camera to be placed on microscope eyepieces; images should be taken and analyzed with software; macrolens for use as video camera and other accessories.		
d.	Variable Transformer.		
e.	Electromagnet: without pole shoes together with differently shaped pole pieces; U-shaped iron core with coils; clamping system with threaded drive for sensitive air gap adjustment with suitable pole piece.		
f.	Pole pieces: conical pole pieces, drilled, with mounted flange.		
g.	Optical bench and accessories: to hold all necessary components.		
h.	Polarization specimen: $\lambda/4$ plate at 550 nm; made of mica.		
i.	Rotary table: for heavy loads; metal base plate with tilt adjustable feet and bearing mounted metal top plate.		
j.	Capacitor: electrolytic capacitor in cylindrical metal case.		
17.	<b>Item No. 6: Franck-Hertz experiment</b> : Complete experimental set up to determine the excitation energy of Neon by accelerating electrons in a Neon-filled glass tube and measuring the electron current in dependence with applied voltage. The set up should include:		
a.	Neon tube: Tetrode in Neon-filled glass tube stable housing with viewing window and connection to operating unit for recording the Franck-Hertz curve with up to at least 5 excitations and direct observation of light emission in the visible range.		
b.	Control Unit: compact operating unit for Franck-Hertz experiment to be used with Hg- or Ne-tubes with automatic detection of tube type and automatic limitation of tube parameter. Examination by direct reading of displayed values, xyt-recorder, oscilloscope or PC.		
c.	Data acquisition and analysis software: operating unit to be identified by the software automatically, presettings for given experiment; multi-user license.		
18.	<b>Item No. 7: Hall effect with p-Germanium with interface</b> : Complete experimental set up to measure the resistivity and Hall voltage of a rectangular germanium sample as a function of temperature and magnetic field. The complete set up should include		
a.	Hall effect module: an appropriate module to hold and supply carrier boards for the Hall effect experiment.		
b.	Hall effect carrier board, p-Ge: for determination of temperature dependent Hall voltage and conductivity of doped semiconductors in connection with Hall effect module.		



c.	Computer interface: for measurement and control of experiments.		
d.	Interface sensor unit magnetic fields: plug-in module for a precise measurement of magnetic DC and AC fields. Readily calibrated; Multiple measuring ranges up to $\pm 1$ T; max. resolution at least $5 \mu\text{T}$ ; compensation $\pm 1$ T in all measuring ranges.		
e.	Magnetic field probe: tangential hall sensor for measuring magnetic flux densities in combination with a Teslometer or interface system. Material: GaAs, monocrystalline.		
f.	Software for Hall effect: for measuring all relevant quantities of the hall experiment, i.e. Hall-voltage, current, voltage, magnetic field and temperature; compatible with interface and sensor unit; automatic recognition of connected sensor.		
g.	Power supply: high performance, stabilized low voltage source; short-circuit proof DC voltage output; can be operated both as an electronically regulated DC source and as a regulated constant current source; all voltages are galvanically separated from the mains and are within the low voltage protection range. Output voltage: ripple max. 1 mV.		
h.	Coil: pair of coils with on shock-resistant frame with safety plugs.		
i.	Iron core: U-shaped, laminated, iron core made out of low loss soft iron dynamo plates, riveted.		
j.	Pole pieces: Plane pair of pole pieces, especially suited to generate a homogeneous magnetic field (e.g. for Hall effect carrier boards) for attaching on iron core		
k.	Digital Multimeter: To perform the necessary functions.		
19.	<b>Item No.8 :Ultrasonic diffraction at different single and double slit systems:</b> Complete experimental set up to record the intensity of the diffracted and interfering partial ultrasonic waves at single slits of various widths as well as various double slits using a motordriven goniometer system. The set-up should include:		
a.	Step motor-driven goniometer with adjustable fixation bar for ultrasonic transmitter, mirror and ultrasonic receiver, with a beam length of at least 550 mm, measurement range of at least 120 degrees, angle solution of less than 0.15 degrees, diameter of at least 250 mm, circular experimentation plate to position diffraction objects in the center of rotation of the goniometer beam		
b.	Reflecting mirror		

c.	Object holder and diffraction objects		
d.	Ultrasonic transmitter and receiver		
e.	Goniometer operation unit for manual, programmable and PC operation, with LED to display angles, velocity and step width		
f.	Software to drive goniometer and for data acquisition and analysis		
20.	<b>All necessary parts including optics, connecting cables, support material, other auxiliary material and teachware to perform the experiment should be included.</b> (PC not required)		
21.	<b>Installation and Training: -on-site installation and demonstration of the instruments</b> <b>- training to get hand-on experience with the instruments</b>		