

# S. N. Bose National Centre for Basic Sciences

Block JD, Sector III, Salt Lake, Kolkata – 700098

(An autonomous national centre funded by the Department of Science & Technology, Government of India)

Tender No.SNB/PUR/OT/20/003

Date: 24/04/2013

## OPEN TENDER

Sealed tender in two parts (separate technical bid and price bid) are invited in the name of the Director, S.N. Bose National Centre for Basic Sciences from reputed equipment vendors for the following items. The detailed technical specifications and terms & conditions can be obtained from the website: <http://www.bose.res.in>.

The sealed tenders must reach this office within 30 days from the date of publication of this advertisement.

<i>Sl.No.</i>	<i>Name of Item</i>
1.	Laser Wavelength Meter
2.	High Reflectivity Cavity Mirrors
3.	Mid-Infrared Quantum Cascade Laser at 7.8 Micron
4.	Mid-Infrared Quantum Cascade Laser at 5.3 Micron
5.	Femtosecond amplifier system and other accessories
6.	Motorized Delay Stage with Controller Electronics
7.	Programmable Bipolar Power Supply
8.	XYZ Piezoelectric Stage Controller Electronics
9.	Lock-in-Amplifier with digital signal processing (DSP)
10.	1 GHz Digital Storage Oscilloscope
11.	Three joined Optical tables with suitable vibration isolators, automatic leveling and air compressors
12.	Helium Leak Detector
13.	2000 Liquid Nitrogen(N <sub>2</sub> ) Dewar
14.	Liquid Nitrogen(N <sub>2</sub> ) Bath Cryostat with optical window
15.	240 Litres Liquid Nitrogen(N <sub>2</sub> ) Dewar
16.	Oscilloscope: 500 MHz, 1 GS/s and 4 Ch
17.	Vibration isolation optical table

Registrar

# S. N. Bose National Centre for Basic Sciences

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## NOTICE INVITING TENDER

Tender No.SNB/PUR/OT/20/003

Date: 24/04/2013

Sealed tenders are invited for the equipment as per the details enclosed from the reputed, established and competent manufacturers / suppliers in two bids – technical and financial. The details of tender documents are as follows:-

1.	<i>Name of office inviting tender</i>	S.N. Bose National Centre for Basic Sciences Block JD, Sector III, Salt Lake, Kolkata – 700098
2.	<i>Name of equipments</i>	Mentioned in Annexure – I
3.	<i>Specifications of the equipments</i>	Can be obtained / downloaded from our website address: www.bose.res.in
4.	<i>Separate bid for Part-A: Technical and Part-B: Commercial</i>	One large envelope having two smaller envelopes containing separately – Part-A: Technical bid and Part-B: Commercial bid need to be submitted. Two smaller envelopes should be superscribed Technical bid / Commercial bid as the case may be.
5.	<i>Submission of Tender</i>	The tender documents duly filled in arranged and sealed in aforesaid manner should be sent to: The Director, at the address given under Sl.No.1 above so as to reach him within 30 days of date of publication of advertisement. The envelope should be superscribed “Tender for Item ..... Against Advt. No..... dtd.....” The commercial bid of only technical qualified tenders will be opened.
6.	<i>Opening of Commercial bid</i>	The Commercial bid will be opened in the presence of Tenderers / their representatives. The tenderer who will qualify for above will be notified in due course after technical selection.
7.	<i>Documents to be attached along with the tender</i>	A list showing names and address of the National Research Institutes / Universities / Centre of Higher Learning around the world to whom similar equipments have been sold mentioning Model number and year of manufacture / supply, including those sold in India.

This Centre will not be responsible for postal or any other delay and the **Authority of the Centre reserves the right to accept or reject any or all tenders without assigning any reason.** Tenders / offers sent by fax / email will not be entertained and would be rejected.

DIRECTOR

S.N. BOSE NATIONAL CENTRE FOR BASIC SCIENCES

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17.	Vibration isolation optical table

### **General Terms & Conditions:**

- 1) The bid should be submitted in two bid system each of which is to be submitted in separate envelope. One envelope should contain “techno commercial bid” i.e, technical specifications, terms and condition, terms of payment except price and another envelope should contain price of the quoted item. Both the envelopes should be separately sealed and kept in another large envelope which should be marked with tender reference number, name of the equipment and tender opening date.
- 2) The tenderer should have high technical, financial reputation with sufficient experience and capable enough for supply, installation & commissioning of similar type of equipment to actual users.
- 3) Against such offers, if statutory requirement demands clearance from concerned Governments the tenderers should confirm in their offer that “Export License” in that respect would be arranged by them at their cost.
- 4) Offers should be complete in all respect indicating therein the unit price(s) including manuals, make, model, duties and taxes, delivery period, gross and net weight of the consignment, terms of payment, together with the descriptive leaflet/catalogue/pamphlet.
- 5) The offers shall remain valid at least for a period of **90 days. The period starts from the date of closing of tender submission.**
- 6) The Institute shall not be responsible for delay, loss or non-receipt of the tender through post/Air Mail

- 7) The aforesaid Open Tender is being issued with no financial commitment and purchaser reserves the right to change / vary any items or items thereof at any stage.
- 8) No tenderer shall be entitled for any compensation what so ever for rejection/non consideration of their tender.
- 9) Invitation of tender does not constitute any right or claim for issue of purchase order to the tenderer.
- 10) Only Price Bids will be opened in presence of the bidders or their authorized representative who choose to attend on the date and time informed to them after opening of technical bids and its evaluation.
- 11) The Centre will not be responsible for any misprinting by the news papers concerned and inaccessibility of the downloading facility for any reason whatsoever and in that case the tenderer(s) should contact to the tendering authority to verify the fact in case of confusion.
- 12) If any information furnished by the tenderer is found incorrect or false at a later stage he shall be liable to be debarred from ordering / tendering
- 13) For items originating from abroad 80% payment shall be made by letter of credit and the balance 20% payment will be released after successful completion of installation & commissioning at site.
- 14) For indigenous item, payment will be made after satisfactory installation & commissioning of the equipment / instrument at site.

## **Technical Specification For Item No.01**

### **Wavelength Meter Specification:**

<b>LASER Type</b>	Pulsed and Continuous Wave
<b>Wavelength</b>	
Range	350-1100 nm
Absolute Accuracy [confidence level of $3\sigma$ ( $\geq 99.6\%$ ) and traceable to accepted physical standard]	$\pm 600$ MHz $\pm 0.001$ nm @ 700nm $\pm 0.02$ cm <sup>-1</sup>
Repeatability [Standard deviation for a 5 minute measurement and wavelength resolution should be two times repeatability]	$\pm 60$ MHz $\pm 0.0001$ nm @ 700 nm 0.002cm <sup>-1</sup>
Calibration	Automatic- built-in standard He-Ne Laser
Display Resolution	8 digits
Units	nm or cm <sup>-1</sup> (vacuum), GHz
<b>Optical Input Signal</b>	
Maximum Bandwidth (Measures wavelength of lasers with a bandwidth as high as 450 GHz but reduced accuracy.)	15 GHz
Maximum Input (Required energy from a single laser pulse. Greater sensitivity should be achieved by increasing the length of the measurement window to allow for the integration of a greater number of laser pulse )	15μJ (350 nm) 1μJ (700 nm) 100μJ (1100 nm)
<b>Measurement Rate</b> (The wavelength of every pulse should be measured for a laser operating with a repetition rate of $\leq 200$ Hz. At greater repetition rates, the system should be integrating all pulses arriving within the measurement window.)	200 Hz
<b>Inputs / Outputs</b>	
Optical Input	Collimated beam, 1.5-2 nm diameter aperture, visible tracer beam to facilitate alignment
Instrument Interface	High speed USB 2.0 interface with Windows-based display program library of commands for custom and LabVIEW programming
Computer Requirements	Laptop with preloaded compatible software preferably PC running windows 7, Vista /XP with 1GHz or higher microprocessor , at least 4 GB of available RAM , USB 1.1/2 port, monitor (resolution 1200 × 800 or greater, mouse or other pointing device )

<b>Environmental</b>	
Warm-up Time	None
Temperature	+ 15 °C to + 30°C (-10 °C to +70 °C storage)
Pressure	500-900 mm Hg
Humidity	≤ 90% R.H at 40 °C (no condensation)
<b>Power Requirements</b>	90-264 VAC, 47-63 Hz, 50VA max

Note: (1) Vendors must provide a compatible laptop (at least 4 GB RAM, 500 HD, windows based) with pre-loaded control software with the wavemeter.

(2) The vendors must provide all the required power supply cables, optical fibre cables and software CD with the wavemeter.

(3) Minimum standard warranty period should not be less than 2 years from the date of installation


(4) Additional warranty and after sales services and maintenance may also be quoted separately.

 Quantity Required: 01 no.

## **Technical Specification For Item No.02**

### **High Reflectivity Cavity Mirrors:**

1. Centre Wavelength: 405 nm  
Reflectivity:  $R > 99.995\%$   
Bandwidth: 390-425 nm  
Diameter: 1" (inch)  
ROC: 1 m  
Substrate: Fused Silica Substrate

 *Quantity Required: 02 pairs.*

2. Cleaning and Inspection Blocks for high-reflectivity cavity mirrors

 *Quantity Required: 01 no.*

Note: Vendors must provide the data sheet for the reflectivity curve

## **Technical Specification For Item No.03**

### Mid-Infrared Quantum Cascade Lasers

#### Quantum Cascade Laser at 7.8 micron

##### Optical Parameters

Centre wavelength	7.8 $\mu\text{m}$ (1282 $\text{cm}^{-1}$ )
High resolution (better than 0.0003 $\text{cm}^{-1}$ ) Mode-Hop-Free Tuning Range	$\geq 30 \text{ cm}^{-1}$
Continuous wave tuning range	$> 60 \text{ cm}^{-1}$ typical
Line width	$< 10 \text{ MHz}$ (CW-MHF-FWHM)
Minimum Ave. Power	1 mw
Maximum Ave. Power	$> 70\text{mW}$
Power variation	$< 1\%$ over 5 min, $< 4\%$ average over 1 day
Beam Divergence	$< 5 \text{ mrad}$
Polarization	Linear 100:1
Pointing Stability	$< 1 \text{ mrad}$ upto 100 $\text{cm}^{-1}$ tuning
Spot size Minimum	$< 2.5\text{mm}$
Beam Quality	$TEM_{00}$

##### Electrical parameter:

Triggering	Internal and External Pulse
Scanning	Uni- and Bi directional survey scans, start, stop, step, Pause scanning
External interface	RS-232/ USB 2.0/GPIB (preferable)
Piezoelectric Modulation	Upto 1 $\text{cm}^{-1}$ at 100 Hz, $\geq 600 \text{ Hz}$ bandwidth
Current Modulation	$\geq 0.05 \text{ cm}^{-1}$ at 200 Hz to 2 MHz
Operation	Continuous wave mode-hop-free

##### Mechanical Parameters

Full Range Tuning speed	$< 3 \text{ s}$ for 30 $\text{cm}^{-1}$ scan
Display Accuracy	$\pm 0.5 \text{ cm}^{-1}$ uni-directional
Display Repeatability	$< 0.02 \text{ cm}^{-1}$ uni-directional
Cooling requirement	Scope includes supply of water chillier

 Quantity Required: 01 no.



**Note:**

- (1) Laser must include all the accessories such as tunable laser controller box, water chiller compatible with the laser system, all required cables, CDs, manual and mid-IR viewing cards (minimum two).
- (2) Minimum 1 year standard warranty should be provided from the date of installation.
- (3) Additional warranty, after sales services and maintenance may be quoted separately
- (4) Vendors must supply supporting data and proper documentation (worksheets, test reports, credential etc) along with a compliance sheet.

## **Technical Specification For Item No.04**

# Mid-Infrared Quantum Cascade Laser

## Quantum Cascade Laser at 5.3 Micron

### Optical Parameters

Centre wavelength	5.3 $\mu\text{m}$ ( $1886\text{ cm}^{-1}$ )
High resolution (better than $0.0003\text{ cm}^{-1}$ ) Mode-Hop-Free Tuning Range	$\geq 30\text{ cm}^{-1}$
Continuous wave tuning range	$> 60\text{ cm}^{-1}$ typical
Line width	$< 10\text{ MHz}$ (CW-MHF-FWHM)
Minimum Ave. Power	1 mw
Maximum Ave. Power	$> 70\text{mW}$
Power variation	$< 1\%$ over 5 min, $< 4\%$ average over 1 day
Beam Divergence	$< 5\text{ mrad}$
Polarization	Linear 100:1
Pointing Stability	$< 1\text{ mrad}$ upto $100\text{ cm}^{-1}$ tuning
Spot size Minimum	$< 2.5\text{mm}$
Beam Quality	$TEM_{00}$

### Electrical parameter:

Triggering	Internal and External Pulse
Scanning	Uni- and Bi directional survey scans, start, stop, step, Pause scanning
External interface	RS-232/ USB 2.0/GPIB (preferable)
Piezoelectric Modulation	Upto $1\text{ cm}^{-1}$ at 100 Hz, $\geq 600\text{ Hz}$ bandwidth
Current Modulation	$\geq 0.05\text{ cm}^{-1}$ at 200 Hz to 2 MHz
Operation	Continuous wave mode-hop-free

### Mechanical Parameters

Full Range Tuning speed	$< 3\text{ s}$ for $30\text{ cm}^{-1}$ scan
Display Accuracy	$\pm 0.5\text{ cm}^{-1}$ uni-directional
Display Repeatability	$< 0.02\text{ cm}^{-1}$ uni-directional
Cooling requirement	Scope includes supply of water chillier

 Quantity Required: 01 no.

**Note:**

- (1) Laser must include all the accessories such as tunable laser controller box, water chiller compatible with the laser system, all required cables, CD, manual and mid-IR viewing cards (minimum two).
- (2) Minimum 1 year Standard warranty should be provided from the date of installation.
- (3) Additional warranty, after sales services and maintenance may be quoted separately
- (4) Vendors must supply supporting data and proper documentation (worksheets, test reports, credential etc) along with a compliance sheet.

## **Technical Specification For Item No.05**

### **Detailed Technical Specifications:**

#### **1. Femtosecond Laser Amplifier, SHG/THG, OPA and other Accessories**

##### **A. One Box KHz Regenerative Amplifier Capable of Pumping OPA**

The minimum one box KHz amplifier specifications must be:

- Wavelength: 800 nm
- Pulse energy:  $\geq 3.5\text{mJ}$
- Rep Rate: 1KHz
- Pulse duration:  $< 50\text{fs}$
- Beam quality:  $M^2 < 1.3$
- Energy stability:  $< 0.5\%$  rms ( over 8 hrs)
- Polarization: linear, horizontal
- Contrast Ratio:  $> 1000: 1$  Pre pulse  
 $> 100: 1$  post pulse
- Beam Diameter:  $< 10\text{mm}$

The Ti:Sapphire oscillator/amplifier system must utilize a thermally-stabilized regenerative cavity to comfortably meet long-term stability specifications.

The amplifier must use dual Pockel cells (intra-cavity) in order to allow independent optimization of pulse injection and ejection.

 Quantity Required: 01 no.

##### **B. Integrated Mode locked One box Titanium Sapphire Laser Oscillator:**

- Average power: 200mW @ 800nm
- RMS noise:  $< 0.1\%$  (10Hz-10MHz)
- Power Stability:  $< \pm 1\%$  over 2 hours period
- Polarization: Horizontal
- Repetition Rate: 80 MHz
- Beam Divergence:  $< 1.3\text{ mrad}$
- Beam Diameter:  $< 2\text{ mm}$
- Bandwidth:  $> 30\text{nm}$  ( to get  $< 50\text{ fs}$  pulse from amplifier conveniently)

 Quantity Required: 01 no.

##### **C. Integrated Pump laser for the Ti: sapphire oscillator:**

- Wavelength: 532nm
- Linewidth:  $< 5\text{MHz}$
- Power: 2W
- Spatial Mode: TEM00
- Beam Quality:  $M^2 < 1.1$
- Beam Divergence:  $< 0.5\text{mrad}$

- Polarization: vertical, > 100:1
- Power Stability: < +/- 1%
- Noise: < 0.02% ( 10Hz to 100MHz)

 Quantity Required: 01 no.

## D. Required Q-switched DPSS Pump Laser for Amplifier

Performance and Capabilities:

- |                          |                               |
|--------------------------|-------------------------------|
| • Wavelength             | 527nm                         |
| • Pulse Repetition Rate  | 1kHz                          |
| • Pulse Energy           | >20mJ @ 1kHz                  |
| • Pulse Energy Stability | < 0.5% rms over 8 hour period |
| • Pulseswidth            | < 250ns                       |
| • Beam Divergence        | < 10mrad                      |
- The amplifier must have a 527 nm pump laser fully integrated on the same thermally stabilized platform into the amplifier enclosure to provide a thermally stable system, to minimize beam walking, and to minimize sensitivity to changing environmental conditions such as air flow, humidity and temperature.
  - The 527 nm pump laser must be based on diode-pumped technology to ensure long-term shot-to-shot pulse energy stability, and long lifetime.

 Quantity Required: 01 no.

## E. Optical Parametric Amplifier System: OPA system must integrate all components with the following minimum properties:

The OPA system must have single laptop computer control of all components with unified software control to allow operators to adjust system parameters and verify status of the optimization loops.

The system should use a fresh pump for optimum spatial, temporal & spectral mixing performance

- OPA shall have accessories that extended the wavelength range from 290nm to 2600 nm.
- Repetition Rate: 1KHz
- Input Pump duration: 40 – 60 fs
- Acceptable pump Energy: upto 4mJ
- Energy when pumped with 1mJ ( the OPA output energy should scale linearly with the pump energy)
  - 1140 – 2600 nm: > 220μJ
  - 533 – 1150 nm: > 30 μJ
  - 480 – 533 nm: > 40μJ
  - 290 – 480 nm: > 5 μJ
- All routing optics for pumping OPA should be included.

 Quantity Required: 01 no.

## **F. Harmonic Generators for Amplifier**

- A single box harmonic generator
- Harmonics: SHG & THG
- Conversion Efficiency: 15% (SHG); 2.5% (THG) or better.

 Quantity Required: 01 no.

## **G. Accessories required for the System**

### **Power meter for the system**

- Capable of measuring average power output (all wavelengths) of oscillator, amplifier and OPAs
- Wavelength range: ~ 300 - 10,000 nm
- Power range: few hundred  $\mu$ W to 30 Watt

### **IR Viewer:**

- Wavelength range: 350-1500 nm
- Power supply: battery

### **Fiber optic Spectrometer for spectrum analysis**

- Wavelength range: 350-1000 nm
- Spectral resolution: 1.5 nm or better
- Coupling fiber cable: more than 2 m long
- Accessories for USB interfacing with computer

### **Interferometer based autocorrelator device with SHG based signal detection**

Scan ranges: 150 fs ... 15 ps  
Delay resolution (smallest scan range) < 0.5 fs  
Measurable pulse width: < 50 fs ... 3.5 ps  
Wavelength range: 700- 1100nm ( for Oscillator & Amplifier)  
420 – 2600nm ( for OPA )

Frictionless scanner design based on elastic springs moved by magnetic force.

Real-time position measurement system.

Linear time scale and different factory calibrated scan ranges.

Control Software for windows based PC.

Provision for user friendly exchange of detectors (either photomultiplier or photodiode based).

Motorized turning of nonlinear crystal for phase matching to input wavelength operated via the Control Software.

Fringe resolved as well as intensity autocorrelation possible.

**The system should include Chillers and Computers/Laptops wherever required.**

**Upgradation of all softwares should be specified.**

 Quantity Required: 01 no.

## **Technical Specification For Item No.06**

### **A. Detailed specifications of Motorized Delay Stage with Controller Electronics**

- Travel range: 300 mm.
- Resolution: 1.25  $\mu\text{m}$  or better.
- Minimum incremental motion, linear: 1.25  $\mu\text{m}$  or better.
- On-axis accuracy: 15 or  $\pm 7.5$   $\mu\text{m}$ .
- Bidirectional Repeatability:  $\pm 1.25$   $\mu\text{m}$  or better.
- Unidirectional Repeatability: 1.25  $\mu\text{m}$  or better.
- Maximum speed: 200 mm/s or better
- Load capacity: 600 N.
- Pitch: 250  $\mu\text{rad}$ ; Yaw: 200  $\mu\text{rad}$
- Limit and reference switches present.
- Motor type: 2-phase stepper/DC motor.
- Motor controller electronics with single-axis control.
- Power supply and cable included.
- Motor controller electronics to be interfaced (USB/GPIB/RS-232) with a computer.
- Software driver: Labview drivers and general command sets compatible with GPIB and NI-VISA included.
- Connectors and manuals (operation and programmer's manuals) included.
- Warranty (on-site) 3 years.

 *Quantity Required: 01 no.*

### **B. Detailed specifications of Motorized Delay Stage with Controller Electronics**

- Travel: 500 mm or more.
- Resolution: 1.25  $\mu\text{m}$  or better.
- Bidirectional Repeatability:  $\pm 1.25$   $\mu\text{m}$  or better.
- Unidirectional Repeatability: 1.25  $\mu\text{m}$  or better.
- Maximum speed:  $> 50$  mm/s or higher
- Load capacity:  $> 500$  N.
- Pitch: 250; Yaw: 300
- Limit and reference switches present.
- Motor type: 2-phase stepper/DC motor or better.
- Motor controller electronics with single-axis control.
- Power supply and cable included.
- Motor controller electronics to be interfaced (USB/GPIB/RS-232) with a computer.

- Software driver: Labview drivers and general command sets compatible with GPIB and NI-VISA included.
- Connectors and manuals (operation and programmer's manuals) included.
- Warranty (on-site) 3 years.

 *Quantity Required: 01 no.*



## **Technical Specification For Item No.07**

### **Detailed specifications of Programmable Bipolar Power Supply**

DC OUTPUT	
Power range	1.5 kW
Current:	$\pm 20A$
Voltage:	$\pm 75 VDC$
Regulation topology:	Analog
Converter topology:	Switch-mode pre-regulation with linear bipolar transistors as output stage
PERFORMANCE	
Warm up time (cold):	$\leq 30$ min
Warm up time (stand-by):	$\leq 15$ min
Drift: Long term 8 hours (fwhm)):	$\pm 120$ ppm or better
Line regulation	$\pm 10\%$ slow, $T > 1$ min.: $\pm 50$ ppm $\pm 1\%$ fast, $T > 3$ m sec.: $\pm 50$ ppm
Load regulation	+/- 10% resistance change: $< 500$ ppm
Output ripple and noise	Voltage – peak to peak: $< 100$ mV @ 0-100 kHz
Load Range	Time constant (L/R): 0 - 2.5 sec Inductance (L): 0 – 1 H (standard) Resistance (R): 0.5 – 4 Ohms
Temperature coefficient	$\pm 10$ ppm/ $^{\circ}$ C
Current setting resolution:	Linear / 15 bit + sign (remote/local)
Current reproducibility:	$\pm 25$ ppm
Absolute current calibration:	0.1 %
Current readback resolution:	Linear
Current control range:	$\pm 100\%$
Slew rate limit	5 A/sec to 400 A/sec
Current loop bandwidth:	0.5 Hz, 5 Hz or 20 Hz (jumper inside) @ 1 Ohm, resistive load
Voltage loop bandwidth	200 Hz

CONTROL PANEL	Voltage Display, 5 digits, 16 bit res. Current Display, 5 digits, 16 bit res. Interlock status: LED Push buttons and LEDs
Remote control / interfacing	GPIB or USB (high speed) or RS232 All analog input/output values must be controllable and readable via the remote control interface. In addition a set of basic commands/status messages must be available via the remote control interface.
TEMPERATURE RATINGS	Ambient: 10 – 40° C Storage temperature: 5 – 40° C, non-condensing
DIMENSIONS	19 inch rack mountable.
Weight	Less than 30 Kg
AC INPUT:	Mains, voltage: 360-440 VAC, 3 phase, 50-60 Hz

 Quantity Required: 01 no.

## **Technical Specification For Item No.08**

### **Detailed specifications of XYZ Piezoelectric Stage and Controller Electronics**

#### **Two linear motor stages each with following specs.**

- Travel Range: 50 mm
- Load Capacity: 100 N
- Minimum Incremental Motion, Linear: 0.001  $\mu\text{m}$
- On-Axis Accuracy: 1.5 or  $\pm 0.75 \mu\text{m}$
- Bi-directional Repeatability: 0.08 or  $\pm 0.04 \mu\text{m}$
- Uni-directional Repeatability, Guaranteed: 0.05  $\mu\text{m}$
- Maximum Speed: 300 mm/s
- Pitch: 50 or  $\pm 25 \mu\text{rad}$
- Yaw: 50 or  $\pm 25 \mu\text{rad}$
- MTBF: 20,000 h
- Normal Load Capacity (Cz): 100 N
- Axial Load Capacity (+Cx): 16 N

#### **One vertical linear stage**

- Minimum Incremental Motion, Linear: 0.1  $\mu\text{m}$
- On-Axis Accuracy: 2 or  $\pm 1 \mu\text{m}$
- Maximum Speed: 10 mm/s
- Bi-directional Repeatability: 0.2 or  $\pm 0.1 \mu\text{m}$
- Straightness, Flatness: 1.5 or  $\pm 0.75 \mu\text{m}$
- Yaw: 50 or  $\pm 25 \mu\text{rad}$
- Roll: 50 or  $\pm 25 \mu\text{rad}$
- Normal Load Capacity (Cz): 40 N
- Off-Center Load Equation (Q):  $Q \leq C_z / (1 + D/30) \text{ N}$ ,  $D_{\text{max}} = 100 \text{ mm}$
- MTBF: 20,000 hours at 25% load and with a 30% duty cycle

#### **Controller and Driver for the XYZ stage**

- Number of Axis: 4
- Interface: LED Power indicator, Stop ALL, Remote connector
- Motion: Synchronized pt to pt, Spindle, Gantry, Linear/circular interpolation, Splines, PVT, Analog tracking, Master-slave
- Compensation: Linear error, backlash compensation, error mapping
- Command Set: Objected oriented language, 100+ functions, TCL generated scripts, EPICS Compatible
- Communication Interfaces: GPIB/USB/Ethernet
- Power Requirements: 230V, 50 Hz
- Motor Control: DC Servo, Stepper, DC Brushless, Piezoelectric stacks, others via pass through card

#### **PWM Drive:**

Number of Axis 1

PWM drive module for brushless motors, 5A/44Vpp max.

Number of Axis 1

PWM drive module for DC brush and stepper motors, 3A/48V max

 Quantity Required: 01 no.

## **Technical Specification For Item No.09**

### **Detailed specifications of Lock-In Amplifier with digital signal processing (DSP)**

#### **General:**

**Bandwidth:** maximum: 100kHz or higher, minimum: 1mHz or lower.

**Frequency resolution:** 4½ digits or 0.1 mHz, whichever is greater.

**Dynamic reserve** > 100dB.

**Time constant:** minimum 10 µs or lower, maximum: 25 ks or greater.

**Display:** 4½-digit LED display.

**Interface:** IEEE-488.2 and RS-232 interfaces standard. All instrument functions should be controlled and read through IEEE-488.2 or RS-232 interfaces. Free Labview drivers available.

#### **Signal Channel:**

**Voltage inputs:** single ended and differential.

**Sensitivity:** 2 nV to 1 V.

**Current input:**  $10^6$  or  $10^8$  V/A.

**Voltage input:** 10 MΩ + 25 pF, AC or DC coupled.

**Current input:** 1 kΩ to virtual ground.

**Gain accuracy:** ±1 % or better.

**Noise:** < 8 nV/√Hz at 1 kHz

**Stability:** < 5 ppm/°C.

#### **Reference Channel:**

**Reference Input:** TTL or sine (400 mVpp min.).

**Input impedance:** 1 MΩ, 25 pF.

**Phase resolution:** 0.01° or better.

**Phase error:** < 1° absolute, <0.001° (relative).

**Orthogonality:** 90° ± 0.001°.

**Internal Ref.:** Synthesized, <0.0001° rms at 1 kHz.

**External Ref.:** 0.005° rms at 1 kHz, 100 ms, 12 dB/oct.

#### **Inputs and Outputs:**

**Ch1 and Ch2:** ±10 V output of X, R, X-noise, Aux 1 or Aux 2, updated at 512 Hz.

**X, Y outputs:** In-phase and quadrature components.

**Aux. A/D inputs:** 4 BNC inputs, ±10 V, 1 mV resolution, sampled at 512 Hz.

**Aux. D/A outputs:** 4 BNC outputs, ±10 V, 1 mV resolution.

**Sine Out:** Internal oscillator analog output.

**TTL Out:** Internal oscillator TTL output.

**Data buffer:** Atleast two 16k point buffers.

**Trigger In (TTL):** Trigger synchronizes data recording.

**Warranty:** 3 year onsite.

 **Quantity Required:** 03 nos.

## **Technical Specification For Item No.10**

### **Detailed specifications of 1 GHz Digital Storage Oscilloscope**

Analog channels	4
Bandwidth (upgradable)	1 GHz
Sample rate	2.5 GSa/s or better
Memory depth	2 Mpts or better
Waveform update rate	1,000,000 waveforms per second
Rise time	≤ 450 ps
Input coupling	AC, DC
Input impedance	Selectable: 1 MΩ ± 1%; II 14 pF, 50 Ω ± 1.5%
Input sensitivity range	1 mV/div to 5 V/div (1MΩ), 1mV/div to 1V/div (50Ω)
Display	> 8 inch WVGA with 64 levels of intensity grading
Resolution	800 (H) x 480 (V) pixel format (screen area) or better
Vertical resolution	8 bits or better
Horizontal resolution	2.5 ps or better
Maximum input voltage	300 Vrms, 400 Vpk; transient overvoltage 1.6 kVpk
Channel-to-channel isolation	> 100:1 from DC to maximum bandwidth
Offset range	± 2 V (1 mV/div to 200 mV/div) ± 50 V (> 200 mV/div to 5 V/div)
DC vertical offset accuracy	± 0.1div ± 2mV ± 1% of offset setting
Time base range (s/div)	500 ps/div to 50 s/div
Time base delay time range	Pre-trigger – Greater of 1 screen width or 250 μs Post-trigger – 1 s to 500 s
Time base accuracy	25 ppm ± 5 ppm per year (aging)
Modes	Main, zoom, roll, XY
Trigger modes	Force, Edge, and Video, Pulse triggering
Trigger holdoff range	40 ns to 10.00 s
Trigger level	Any channel ± 6 div from center screen; External ± 8 V
Acquisition Modes	Normal, Peak detect, Averaging(selectable), High Resolution Mode

Connectivity	Standard USB 2.0 (Host and Device); GPIB/RS 232
Waveform Measurements and Maths	Automatic Parametric Measurements of Signal Parameters like Pk-Pk, Average, Max., Min., rms, top etc. Voltages and Frequency , Period, Width, Duty Cycle, Rise Time, Fall Time Waveform and Set up storage facility. Save and Recall feature Sequence Mode i.e, Segmented Memory should be available (Up to 1000 Frames). Standard 20 Automatic Measurement and Four Math Function Including FFT. Standard Cursor Measurement like $\Delta T$ , $\Delta V$ , Frequency
Power	220-240V, 50/60Hz
Temperature	0 to +50 °C
Humidity	Up to 80% RH at or below +40 °C; up to 45% RH up to +50 °C
Accessories	Certificate of Calibration Documentation CD and Hardcopy Standard probes and Cables
Warranty	3 years, on-site

 Quantity Required: 01 no.

## **Technical Specification For Item No.11**

**Detailed specifications of Three joined Optical tables with suitable vibration isolators, automatic levelling and air compressors**

### **“T ”shaped table Consisting of three table tops and Doubler Joint**

The three tables will be internally joined from core to core such that the entire table surface(“T”-Shape) should behave as a single structure . Flatness Damping, Rigidity of the structure should be the same as individual sections of the table top.

General Specification for Optical Table Top

#### **Optical Table top:**

- Dimension of each table top is 1200 x 2400 x 305 mm
- Working Surface: ferromagnetic stainless steel with at least 3/16 in (4.8 mm) thick with integrated damping layer.
- Surface Flatness:±0.004 (±0.1) over 2ft (600 mm) square
- Surface flatness of the entire "L"-shaped table (after two table tops are joined should maintain the above flatness.
- Core Design: Trussed honey comb, vertically bonded closed cell construction, 0.01 in.(0.25mm) in. (0.76 mm)
- Triple core interface.
- Tuned Damping: Narrow Band hydraulic vibration absorbers.
- Must have at least fourteen narrow band hydraulic vibration absorbers inside the “T”-shaped table top to damp out fundamental modes and their harmonics for frequencies between 20-480Hz.
- All frequencies, shoulders and kinks should be effectively damped.
- Sealed damping fluid must not change over the lifetime of the table.
- Broadband Damping: Constrained layer core, damped working Surface and composite edge finish.
- Mounting Holes: M6-1.0 holes on 25 mm grid, 12.5 mm borders.
- Hole/core sealing: Easy clean conical cup 0.75 in (19mm) deep, Non-corrosive high impact polymer material.
- Maximum dynamic deflection coefficient:  $0.4 \times 10^{-3}$
- Maximum relative motion value [in] :  $< 3.0 \times 10^{-9}$
- Deflection under load:  $< 5.0 \times 10^{-5}$  inch for Length:12'; Width:5'; Thickness:8".

#### **Male doubler joint on Optical Table Top**

#### **Female doubler joint on Optical Table Top**

Lifetime warranty for the table tops.

#### **Vibration isolation Legs:**

Isolators, 23.5 in. height, set of 8,  
990 - 12000 lb load capacity, with tie-bar castor system  
Height Adjustment: 1.3 in.  
Relevelling Accuracy [in]: atleast ±0.010  
Maximum air pressure: 20 - 85psi



Vertical isolation

Res (Hz) 1.0

5 Hz(%): 94

10 Hz (%): 98

Horizontal isolation

Res (Hz): 1.5

5 Hz(%): 85

10 Hz (%): 95

Amplification at resonance

Vertical (dB) : 13

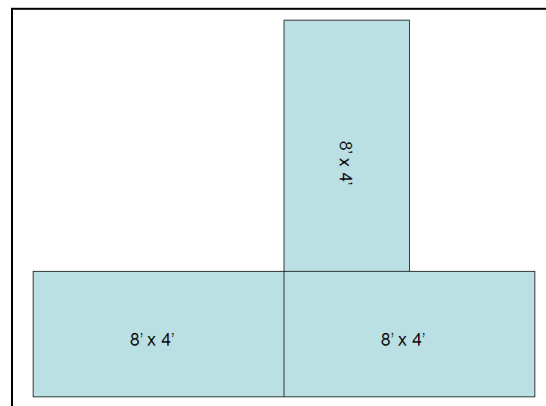
Horizontal (dB) : 13

Damping Element Airflow: Normal

Horizontal.Damping: Oil

Load Per isolator [lb (kg)]: 2000(900)

Load Per isolator [lb (kg)]: 2000(900)



 Quantity Required: 01 no.

## **Technical Specification For Item No.12**

<b>Parameters</b>	<b>Specifications</b>
Operating principle	The Helium leak detector works on the principle of mass spectrometry and is set to the mass of helium ( $m/e = 4$ ).
Analyzer	Self protected 180 degree magnetic deflection mass spectrometer
Detectable Masses	$^3\text{He}$ , $^4\text{He}$ and $\text{H}_2$
Minimum detectable leak	Vacuum mode : $5 \times 10^{-12}$ mbar l/s (approx.)
	Sniffer mode : $1 \times 10^{-7}$ mbar l/s (approx.)
Ready for operation time	Without auto calibration: 2min +/- 10%(approx.)
	With auto calibration : 3 min 30 sec +/- 10%(approx.)
Response time	< 1S(approx.)
Maximum inlet pressure	Not less than 15 mbar
Pumping speed to He	1.1 l/sec(approx.)
High vacuum pump	Type : Turbo molecular drag pump
Backing and roughing pump	Type : Diaphragm Pump 1.7 m <sup>3</sup> /hr
Analyser Cell Filament	2 Y2O3 filaments
Vacuum gauges	Pirani gauges no: 2nos
Degree of protection	20C IP
Power supply	200 - 240V +/- 10%, 50/60Hz, 1Ph
Operation	Should be Completely automatic, single button operation, micro processor based control system with auto calibration and auto ranging or Manual ranging and should be controllable from display control panel
Analog output	Inlet pressure bar graph display,
	Helium leak rate signal bar graph display,

Digital output	Helium leak rate signal digital display
Digital output	System start up status, Calibration, Cycle test status, Helium signal display, 4-Levels of operation menus, leak rate, error messages, Warning messages
Relays	Dry contact max 2A
Interfaces	RS 232, Printer interface

 Quantity Required: 01 no.

### **Technical Specification For Item No.13**

## (A 2000ltr. Dewar of Liquid Nitrogen)

Net Capacity	Gross Capacity	Outside Diameter	Overall Height	Overall Length	Net Evaporation rate	Max. Working Pressure
2000 ltrs	2200 ltrs	48 inch	57 inch	112 inch	1%/day	25 PSIG
Pressure builder	Relief Valve Setting	Secondary relief	Caster Size	Liquid fitting	Vent Fitting	
20 PSIG	22 PSIG	35 PSIG	8 inch	CGA 295 ½" 45 degree Male Flare	3/8 NPT	

N.B.

All the pre-installation requirements including the followings

- i) civil foundations have to be constructed by the vendor at the user's site as per approved drawing (duly supplied by the vendor) and
- ii) liquid nitrogen transfer line also required.

 Quantity Required: 01 no.

## **Technical Specification For Item No.14**

### **Technical specification:**

#### **Liquid N<sub>2</sub> Bath cryostat (sample in vacuum) with optical window**

- Temperature range 77K - 500 K
- Heat exchanger fitted with heater and platinum temperature sensor
  
- Five optical access ports (4 radial and 1 axial) for demountable windows. (Fitted with blanks)
- Optical access f/1 in radial directions
- Temperature stability  $\pm 0.1$  K
- Outer tail dimension around 80 mm (across the flats)
- Nitrogen reservoir size around 1litre
- Cool down time from room temperature
- Liquid nitrogen hold time not less than 15 hr
- Optical sample holder diameter  $\sim 15$ mm (approx) and with clamp
- Optical quartz/spectrosil B windows 1set (5nos). One set of optional optical quartz/spectrosil B windows to be offered separately.
- SS coax (at least 6 ) feed wires terminating in bnc for transport measurement
- Electrical feed wires of Copper for Heater and thermometer
- **Temperature controller:**
- Single channel input
- One PID control loop with upgradeable at least 4 PID control loops
- Heater output 80W per channel
- LCD display with touch-screen
- RS232, USB, Ethernet
- Auto-PID setting
- Should have option for(GBIP) IEEE-488 interface
- Option for (GBIP) IEEE-488 interface
- Option to control auto needle valves
- Option to sense LN<sub>2</sub> and LHe levels
- Cables for electrical measurements

 Quantity Required: 01 no.

Other Requirements:

1	Customers	The vendor should have supplied minimum of two such equipments and the addresses of the customers with telephone and email numbers should be furnished.
2	Service Agency	Should have agents in India to provide after sales service and maintenance.
3	Guarantee	The equipment (solar simulator and related equipment) should be Guaranteed for a period of 2 years from the date of commissioning.
4	Catalogues	Catalogue related to each and every item should be enclosed.
5	Dimensions	Dimensions of equipment, weight and space requirements to be given.
6	Pre-installation requirements	Pre-installation requirements should be furnished.
7	Training	Installation & commissioning of the equipment to be carried out by supplier at site if required.
8	Commissioning charges.	Commissioning charges, if any, to be indicated separately.
9	Compliance statement.	Compliance statement of specification to be submitted along with the offer. Without compliance statement, the offer is liable to be rejected. All tender specifications to be compared with equipment offered line by line and documentary evidence must be enclosed by the supplier along with quotation.
10.	AMC after warranty period	AMC charges for next five years after the guarantee/ warranty/ free service period should be mentioned. Please note that this will taken in to account for price comparison

**Technical Specification For Item No.15**

**(A 240ltr. Dewar of Liquid Nitrogen)**

Net Capacity	Gross Capacity	Outside Diameter	Overall Height	Level Gauge	Net Evaporation rate	Max. Working Pressure
240 Ltrs	248 Ltrs	24 inch	63 inch	Yes	3 Ltrs/day	25 PSIG

Regulator Setting	Relief Valve Setting	Secondary relief	Caster Size	Liquid fitting	Vent Fitting
20 PSIG	22 PSIG	100 PSIG	4 inch	CGA 295 ½" 45 degree Male Flare	3/8 NPT

 Quantity Required: 01 no.

## **Technical Specification For Item No.16**

**Oscilloscope:  
500 MHz, 1 GS/s and 4 Ch**

<b>Vertical system</b>	
Bandwidth	500 MHz
Rise time	750 ps
Input Channels	4
Bandwidth Limiters	20 MHz, 100 MHz
Input Impedance	1 M $\Omega$ $\pm$ 1.5%    16 pF, 50 $\Omega$ $\pm$ 1.5%
Input Coupling	AC, DC, GND
Maximum Input Voltage	1 M $\Omega$ : $\pm$ 400 V <sub>pk</sub> , 50 $\Omega$ : 5 VRMS
Channel-Channel Isolation	$\geq$ 34 dB from DC - 100 MHz $\geq$ 30 dB at 500 MHz
Vertical Resolution	8 bits
Sensitivity	1 M $\Omega$ : 2 mV/div - 10 V/div 50 $\Omega$ : 2 mV/div - 2 V/div
DC Gain Accuracy	$\pm$ (1.5% + 0.5% of Full Scale)
Offset Range	$\pm$ 1 V: 2 mV/div - 50 mV/div $\pm$ 10 V: 50.2 mV/div - 500 mV/div $\pm$ 100 V: 502 mV/div - 10 V/div
<b>Horizontal System</b>	
Time/Division Range	500 ps/div - 50 s/div
Clock Accuracy	10 ppm
Trigger and Interpolator Jitter	200 ps (pk-pk)
<b>Acquisition System</b>	
Single-Shot Sample Rate/Ch	2 GS/s on 1 Ch 1 GS/s on 2 Ch
Equivalent Sample Rate	100 GS/s
Memory	500 kpts/Ch
<b>Acquisition Modes</b>	



Averaging	Selectable Number of Sweeps: 4, 16, 32, 64, 128, 256
Peak Detect	1 ns
Interpolation	Linear
<b>Triggering System</b>	
Modes	Normal, Auto, Single, Stop
Sources	Ch 1 - Ch 4, EXT, EXT/10, AC Line
Coupling Mode	AC, DC, LF Rej, HF Rej,
Hold-off by Time or Events	200 ns - 50 s
Internal Trigger Range	±5 divisions from center
Trigger Sensitivity	0.5 division: DC - 10 MHz 2.0 divisions: 10 MHz - 500 MHz
External Trigger Sensitivity	Ext: 50 mV from DC to 10 MHz 250 mV from 10 MHz to 500 MHz Ext/10: 0.5 V from DC to 10 MHz 2.5 mV from 10 MHz to 500 MHz
External Trigger Input Range	Ext: ±0.5 V, EXT/10: ±5.0 V
<b>Display</b>	
Type	Color TFT-LCD
Resolution	VGA: 640 x 480
Grid Styles	YT, XY
<b>Internal Storage</b>	
Waveform Storage	1 reference waveform
Setup Storage	5 setups
<b>Math</b>	
Number of Math Traces	1
Standard Math Functions	Add, Subtract, Multiply, FFT
<b>Measurements</b>	
Number of Measurements Displayed	4

Measurement Parameters	Base, Cyclical Mean, Cyclical RMS, Duty Cycle, Fall Time (90% - 10%), Fall Time (80% - 20%), Frequency Integral, Maximum, Mean, Minimum, Number of +Pulses, Number of -Pulses, +Overshoot, -Overshoot, Peak-Peak, +Pulse Width, -Pulse Width, Rise Time (20% - 80%), Rise Time (10% - 90%), RMS, Skew, Skew@level, Top, Top-BAsE
<b>Probes</b>	
Probes	Qty. (4) ÷10 Passive Probes
Scale Factors	Automatic: ÷1, ÷10, ÷100, ÷1000 Manual: ÷1, ÷10, ÷20, ÷100, ÷200, ÷1000, ÷2000
Calibration Output	1 kHz square wave, 0.6 Vp-p (typical), output to probe hook
<b>Interface</b>	
GPIB Port	1
USB	1
Ethernet Port	1
USB (Host)	1
Serial Port	na
<b>Power Requirements</b>	
Voltage	90 - 264 VAC, 47 HZ - 420 Hz
Max. Power Consumption	75 VA
<b>Environmental and Safety</b>	
Temperature (Operating)	0 °C to 40 °C
Temperature (Non-Operating)	-20 °C to 60 °C
Humidity (Operating)	80% RH, 40 °C
Humidity (Non-Operating)	80% RH, 40 °C
Altitude (Operating)	2000 m
Altitude (Non-Operating)	15000 m

Note: (1) Lan Card, GPIB card, all relevant ports/cables and manual, CD should be supplied with the oscilloscope.

(2) Minimum 1 year Standard warranty should be provided from the date of installation.

(3) Additional warranty, after sales services and maintenance may be quoted separately.

 Quantity Required: 01 no.

## **Technical Specification For Item No.17**

### **Optical Table:**

Length: 8 feet

Width: 4 feet

Thickness: 12 inch

Mounting Hole Type: M6-1.0

Mounting Hole Pattern: 25 mm grid

Working Surface: ferromagnetic stainless steel with at least 3/16 in (4.8 mm) thick with integrated damping layer.

Surface Flatness:  $\pm 0.1$  mm over 600 mm square

Deflection Under Load:  $< 5 \times 10^{-5}$  inch

Maximum Dynamic Deflection Coefficient:  $0.4 \times 10^{-3}$

Maximum Relative Motion :  $< 7.6 \times 10^{-8}$  mm

Deflection Under Load mm:  $< 1.3 \times 10^{-3}$  mm

Core Design: Trussed Honeycomb, Vertically Bonded Closed Cell Construction, 0.010 in. Steel sheet materials, 0.030 in. triple core interface

Tuned Damping: Narrow Band hydraulic vibration absorbers.

Broadband Damping: Constrained layer core, damped working surface and composite edge finish

Hole/Core Sealing: Easy clean conical cup, Non-corrosive high impact polymer material

Top and Bottom Skins:  $5 \pm 0.2$  mm thick with integrated damping layer

### **Vibration Isolation Support:**

Compatible to the above mentioned table

Number of isolators: 4

Height:  $23 \pm 2$  inch

Height Adjustment:  $30 \pm 5$  mm

Pneumatic isolators with automatic levelling

Settling time:  $< 1.5$  sec

Re-levelling Accuracy:  $\pm 0.01$  inch

Resonance: 1.0 Hz

Vertical Isolation :

5 Hz: 95 % or better; 10 Hz: 98% or better

Horizontal isolation :

5 Hz: 85% or better; 10 Hz: 95% or better

Amplification at resonance

Vertical: 10 dB or better; Horizontal: 10 dB or better

Load per isolator: 900 kg

Self centering ability

**Air-Compression Systems for Pneumatic Isolators:**

Compatible to the above mentioned items and should contain regulator filter, air tank filter and automatic turn off switch

Operating Sound Level (1ft): 30 dB

Release value sound level: 60 dB

Flow Rate (20-80 psi): 0.80-0.68

Tank Capacity (liters): 3.5

 *Quantity Required: 02 nos.*

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