Detailed Specifications of Short Terms Global Tender Notice No: 17/2015

S. NO	TENDER NO.	BRIEF DETAILS OF ITEM(S)	PAGE NOS.
1.	**14-VII/HK(2495)15-PB/T-124**	Multiphysics Research Package/ Software consisting of (1) Mechanical FEM Module (2) Radio Frequency (RF) Module (3) Electromagnetic (EM) Module (4) CFD Module	**2-8**
2.	**14-VI/SP(782)15-PB/T-125**	UHV Magnetron Sputtering System	**9-12**
3.	**14-VI/SD(799)15-PB/T-126**	Photon Counting System	**13-14**
4.	**14-VI/SP(801)15-PB/T-127**	(1) Diode Laser @760 nm (2) Fabry- Perot Cavity	**15**

Tender No: 14-VII/HK(2495)15-PB/T-124

Multi-physics Research Package / Software

Specifications

A. Mechanical FEM Module

11|N

Sl. No.	Title	Identification	Detailed Description
A 1	Compatibility with CAD & FEA Software's	A 1.1	Capability to import CAD geometry in standard formats
A 2	Geometric Modeling	A 2.1	2D sketching tools
		A 2.2	3D part tools including capabilities to extrude, revolve and sweep
A 3	User Interface should be easy and consistent for all analysis	A 3.1	Model tree for convenience to build complete FE model
		A 3.2	Material evaluation capability for hyperelastic / viscoelastic
		A 3.3	Multiple viewport support to show models in single screen
A 4	Meshing	A 4.1	Meshing capability for 1D, 2D, 3D elements
		A 4.2	Virtual Topology (combine faces/edges)
		A 4.3	Mesh verification
A 5	Post Processing	A 5.1	Integrated environment for model visualization and results evaluation
		A 5.2	Cross-sectional viewing options for beam elements
		A 5.3	Free body cut to show cross sectional force and moment
		A 5.4	Result contours of displacement, stress, strain etc.
		A 5.5	Capability to create XY data
		A 5.6	Result transformation in local co-ordinate system
		A 5.7	Pre-defined and user-defined color palettes for result contours
		A 5.8	Point-and-click result inquiry options
		A 5.9	Synchronize multiple viewports
A 6	Results Presentation	A 6.1	Output result contours and graphs
		A 6.2	Integrated animation creation and display tools
A 7	Automation	A 7.1	Scripting Interface to assist in performing repetitive tasks
A 8	Structural Analysis Procedure	A 8.1	Linear and nonlinear statics analysis
		A 8.2	Low cycle fatigue
		A 8.3	Steady state transport
		A 8.4	Mass diffusion (transient and steady state)
		A 8.5	Buckling & post-buckling analysis (arc-length methods like RIKS)
		A 8.6	Frequency extraction – preloaded considered
		A 8.7	Complex Eigen value extraction
		A 8.8	Steady state harmonic , Random Response, Response Spectrum, Modal Dynamics
		A 8.9	Ability to solve for flexible multi-body mechanisms where the flexible structure's behavior may be linear or nonlinear
A 9	Nonlinear dynamics	A 9.1	Nonlinear direct integration implicit dynamic

			analysis that could incorporate large scale motion in the analysis
A 10	**Fracture mechanics**	A 10.1	Crack Propagation
		A 10.2	Crack growth in 2D and 3D
		A 10.3	Extended FEM techniques (XFEM)
A 11	**Thermal**	A 11.1	Steady-state and transient analyses
		A 11.2	Sequentially and fully coupled temperature-displacement analysis
		A 11.3	Conduction, Forced Convection, Radiation
A 12	**Coupled Analysis**	A 12.1	Thermal/structural
		A 12.2	Structural/Acoustics
A 13	**Acoustics**	A 13.1	Sound Propagation
		A 13.2	Underwater explosion by the application of incident wave loading either by redesigned interface or alternative interface
		A 13.3	Natural frequency extraction of a cavity containing acoustic fluid, also supports the effects of exterior surrounding fluid
		A 13.4	Acoustic modeling supported in pre-processor
		A 13.5	Special acoustic interface elements
A 14	**Element Types / Formulation**	A 14.1	Continuum Shell elements
		A 14.2	Infinite elements
		A 14.3	Modified 10 noded tetrahedral for handling contact analyses
		A 14.4	Gasket elements: Thickness behavior specified in terms of membrane and transverse shear
A 15	**Material Models**	A 15.1	Elastic: Isotropic, Anisotropic etc.
		A 15.2	Metal Plasticity: Isotropic, kinematic etc.
		A 15.3	Crushable foam plasticity
		A 15.4	Concrete, Damaged plasticity
		A 15.5	Viscoelasticity
		A 15.6	Hyperelasticity
		A 15.7	Elastomeric and crushable foam
		A 15.8	Extended and capped Drucker-Prager models
		A 15.9	Composite laminate
		A 15.10	Progressive damage and failure
A 16	**Solution Methods**	A 16.1	Symmetric solver
		A 16.2	Unsymmetric solver
		A 16.3	Parallel solver
		A 16.4	Iterative solver
		A 16.5	Multi-CPU run capability
		A 16.6	Restart analysis
		A 16.7	Import Analysis (from implicit to explicit solver and vice versa)
		A 16.8	Adaptive meshing
		A 16.9	Sub modeling
		A 16.10	Co simulation
A 17	**Loading**	A 17.1	Concentrated force/moment, Follower forces, Surface forces, Edge forces, Pressure, Gravity, Hydrostatic etc.
		A 17.2	Heat flux
A 18	**Constraints**	A 18.1	Tie, Rigid Body, Coupling, Equation
		A 18.2	Display Bodies

A 19	**Interaction**	A 19.1	Contact: Point to point, point to surface, surface to surface
		A 19.2	Contact formulations
		A 19.3	General contact
		A 19.4	Friction: Static & Dynamic
A 20	**Miscellaneous**	A 20.1	Import Analysis (from implicit to explicit solver and vice versa)
		A 20.2	Sub-modeling
		A 20.3	Sub-structuring
		A 20.4	Cyclic Symmetry
		A 20.5	Mesh to mesh solution mapping
		A 20.6	Symmetric model generation and results mapping
		A 20.7	Subroutines for defining material models, thermal materials, elements, etc.
A 21	**Analysis Procedure**	A 21.1	Explicit Nonlinear Dynamic
		A 21.2	Fully coupled thermo-mechanical analysis
		A 21.3	Nonlinearity: geometric, material and boundary non-linearity
A 22	**Material**	A 22.1	Elastic: Isotropic, Anistropic, othrotropic and lamina etc.
		A 22.2	Metal Plasticity: Isotropic& kinematic hardening
		A 22.3	Extended and modified Drucker Prager plasticity
		A 22.4	Concrete – Brittle cracking and Damaged plasticity models
		A 22.5	Viscoelasticity
		A 22.6	Hyperelasticity
		A 22.7	Anisotropic Hyperelasticity
		A 22.8	Equation of State (EOS)
		A 22.9	Fabric
		A 22.10	Composite laminate, damage for fiber-reinforced composite etc.
		A 22.11	Progressive damage and failure
A 23	**Surface Modeling**	A 23.1	Surface modeling

B. RF Module

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Sl. No.	Title	Identification	Detailed Description
B 1	**Software Features**	**B 1.1**	3D full-wave electromagnetic field solver
		B 1.2	Automatic and adaptive meshing capability
		B 1.3	Eigen mode solver to calculate Eigen modes and natural resonances for a structure
		B 1.4	Solver for solving modal
		B 1.5	Broadband frequency sweeps
		B 1.6	Advanced computational electromagnetic solve techniques
B 2	**Software Capabilities**	**B 2.1**	Excitations and boundary conditions: Arbitrary internal and external ports; To place microwave ports in any arbitrary direction
		B 2.2	Intelligent Mesh generation
		B 2.3	Material Library: Software should have comprehensive materials database; Software should also be able to take inputs from user specified materials
		B 2.4	Modeler capabilities: Advanced 3D modeling capabilities; Parametric modeling and dynamic editing; 3D objects
		B 2.5	Post processing features: The software should be able to provide following solution data to the user; S-parameters (single-ended, differential, renormalized etc.); Radiated-field calculations
		B 2.6	Advanced analysis features and parallel solve: The software should have analytical derivatives to find output sensitivity; It should have capability of Hybrid finite element; It should have capability for simulation or very large models
		B 2.7	Optimization capability

C. Electromagnetic Module

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Sl. No.	Title	Identification	Detailed Description
C 1	Electromagnetic Module	C 3.1	3 D full wave electromagnetic field solver for permanent magnet and electromagnet simulation upto microwave frequencies based on Finite element method (FEM) / Method of Moment (MoM) / Finite difference time domain (FDTD)
		C 3.2	With adaptive Meshing and parameter optimization capability
		C 3.3	Capable of showing the results in time and frequency domain
		C 3.4	General purpose import utility formats.
		C 3.5	Meshing: Surface meshing with triangular facets; Ability to export meshes; Ability to handle arbitrary curvatures with good accuracy

D: CFD Module

Sl. No.	Title	Identification	Detailed Description
D 1	General Modeling Capabilities Dimension	D 1.1	2D, 3D
D 2	Time Integration and Point Movement	D 2.1	Steady-state analysis
		D 2.2	Transient analysis
		D 2.3	Free surface flows
D 3	Momentum	D 3.1	Generalized Newtonian flow, including yield stress fluid
		D 3.2	Viscoelastic flow
D 4	Energy	D 4.1	Isothermal and non-isothermal
		D 4.2	Heat transfer including natural conduction, forced or mixed convection, conjugate solid/fluid) heat transfer
		D 4.3	Thermal conduction in fluid and solid including moving parts
		D 4.4	Electrical heating in fluid and solid including moving parts
		D 4.5	Volumetric sources of heat
D 5	Geometry	D 5.1	Movement of parts within the fluid and movement of boundaries
		D 5.2	Move velocity
D 6	Material Properties and Rheological Modeling	D 6.1	Constant or variable fluid properties including temperature dependence
		D 6.2	Constant or variable solid properties including temperature
		D 6.3	Temperature variation of the density
		D 6.4	Viscoelastic materials
D 7	Boundary Conditions	D 7.1	Various boundary condition
		D 7.2	Inlet velocity
		D 7.3	Shear stress
		D 7.4	Thermal boundary conditions
		D 7.5	Specified normal velocity
		D 7.6	Transient conditions
D 8	Initial Conditions	D 8.1	User specified profile or map of initial condition
		D 8.2	Importing fluid geometry from a previous computation as initial condition
D 9	Point Cloud Organization	D 9.1	Import geometry
		D 9.2	New points can use with 6-nodes triangles in the case of 3-D
D 10	Numerical Methods	D 10.1	Dynamic memory allocation
		D 10.2	Single and double-precision calculation
D 11	Organization	D 11.1	New Graphical visualization of rate of convergence
D 12	Post Processing	D 12.1	New Integration of a data analysis and visualization application into the GUI
D 13	Pre Processing	D 13.1	Pre processing
D 14	Parallel Processing	D 14.1	Parallel processing on shared memory systems
D 15	Interface, Graphics, Post Processing and Reporting	D 15.1	Interface, Graphics, Post Processing and Reporting
D 16	Data Export	D 16.1	STEP / IGES etc.

E Other Requirements

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Sl. No.	Title	Identification	Detailed Description
E 1	About Software	E 1.1	Full version software with no limitations of node with compatible workstation
E 2	GUI	E 2.1	Same GUI for all modules (Mechanical FEM, RF, EM and CFD)
E 3	Restrictions	E 3.1	No restriction regarding patent and research work publication
E 4	Number of Licenses	E 4.1	05 (Five)
E 5	Licensing mode	E 5.1	Individual workstation / network based
E 6	Support, AMC & Upgradation	E 6.1	02 years from successful installation
E 7	Training	E 7.1	8-10 people at NPL without any extra cost for at least 10 working days
E 8	**Cost Breakup**	**E 8.1**	The cost break-up of each module may also be provided in the financial bid.

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UHV Magnetron Sputtering System:

Scope of the system: A standard UHV Magnetron sputter deposition system consisting of two chambers: one main chamber for deposition and another for load-lock cum preparation chamber. The system shall be configured in sputter down con-focal configuration, should have base pressure range of 1×10^{-9} mbar or better in main growth chamber with all necessary controls, pumps, valves, power supplies, flow control, gas system, magnetron guns etc. It should have reactive and sequential co-sputtering deposition on substrates of upto 1 mm thick and 1 inch diameter. The sputtering system (clean room compatible, Class 10000 minimum) will be used for deposition of high quality, uniform metals and oxide ultrathin superconducting films.

A. ESSENTIAL

1. **MAIN GROWTH CHAMBER:**

1.1 Main chamber with 18 to 20 inches diameter made of 316 SS (or equivalent) to reach base pressure of 1×10^{-9} mbar range or better.

1.2 Chamber should have suitable UHV compatible CF flanges and ports (with compatible blanks) to incorporate the following associated components :

- a. Five magnetron sputter guns with shutters,
- b. Thickness Monitor with shutter,
- c. Sample and mask Manipulator with shutter,
- d. Residual Gas Analyser (RGA),
- e. 2 ports for RHEED assembly,
- f. Pumping system,
- g. Gas control system,
- h. Transferring system,
- i. Two observation viewports with shutters,
- j. Port for Titanium Sublimation Pump (TSP),
- k. Four additional ports of suitable size for future requirement etc.

1.3 Substrate fixture: 1 inch substrate holder with Z–motion (± 2 inch or higher) for working distance adjustment. . Separation between target and substrate approximately 5-6 inches.

1.4 Substrate Rotation: upto 20 RPM with increment of 1RPM.

1.5 Substrate Heater with power system to achieve substrate temperature ≥850 deg.C at 1 inch area. Suitable PID controller and thermocouple to be provided.

1.6 Magnetic arm transfer rod for the easy transfer of samples and mask from load-lock chamber to main chamber and shall be capable of handling substrates upto 1 inch diameter.

1.7 Provision for substrate bias ±200V along with compatible power supply.

2. **LOAD-LOCK CUM PREPARATION CHAMBER:**

2.1 Chamber with 12 inches diameter made of 316 SS (or equivalent) to reach base pressure of 1×10^{-8} mbar range or better.

2.2 Chamber should have suitable UHV compatible CF flanges and ports (with compatible blanks) to connect the following associated components :

- a. Two magnetron sputter guns with shutters.
- b. Cold cathode gun

c. Thickness Monitor with shutter.
d. Sample and Mask Manipulator with shutter,
e. Pumping system,
f. Gas control system,
g. Transferring system,
h. One observation viewports with shutters,
i. Four additional ports of suitable size for future requirement etc.
j. Front door opening with hinges on O-rings in load-lock for preparation work.

2.3 Substrate fixture: 1 inch substrate holder with Z–motion (± 2 inch or higher) for working distance adjustment. Separation between target and substrate approximately 5-6 inches.

2.4 Provision for Substrate Rotation: upto 20 RPM with an increment of 1 RPM.

2.5 Substrate Heater with power system to achieve substrate temperature ≥850 deg.C at 1 inch area. Suitable PID controller and thermocouple to be provided.

2.6 Provision for substrate bias ±200V along with compatible power supply.

3. **PUMPING SYSTEM WITH VACCUM GUAGES**: (of standard make such as Edward/Alcatel/ Pfeiffer/ Oerlikon):

3.1 Suitable and compatible Ion pumps (≥ 400 l/s capacity) in combination with turbo pump (≥ 650 l/s capacity) backed with dry pumps of appropriate capacity to reach base pressure of $1x10^{-9}$ mbar in maximum three hours time, complete set of vacuum gauges with electronic control and read out to measure from atmosphere to 1×10^{-11} mbar and other accessories for growth chambers should be supplied.

3.2 Turbo molecular pump along with compatible Rotary pump of appropriate capacity for load-lock cum preparation chamber to reach base pressure of $1x10^{-8}$ mbar in maximum 90 mins, complete set of vacuum gauges with electronic control and read out to measure from atmosphere to 1×10^{-10} mbar and other accessories shall be supplied.

3.3 Suitable and compatible UHV Vacuum Gauge with display having bakeable cables for both chambers.

3.4 Suitable and Compatible UHV Gate Valves for isolation from main and load-lock chambers.

3.5 Suitable isolation all metal gate-valves for Ion pump to isolate from main chamber.

4. **2″ UHV compatible Magnetron Sputtering Gun (Standard make such as AJA, Angstrom Science, Gencoa) -03 No's**

4.1 One RF and One Pulsed DC sputter gun to be installed in main growth chamber and One RF sputter gun in load-lock (along with water cooling).

4.2 Sputter gun geometry: In–situ tilt compatible sputter source for con–focal, direct and off-axis deposition- Two no's installed in main chamber

4.3 One sputter gun for con-focal deposition installed in load-lock.

4.4 Internal mounting and provision of detachment for easy changing of targets.

4.5 Target diameter 2 inch with typical target thickness of ~1/4 inch.

4.6 Magnets: SmCo magnet array, bakeable~200°C and provision for magnet replacement at user end.

4.7 Compatible for RF power supply upto 300 Watts and 700-800 Watts Pulsed DC power supplies.

4.8 Motorised and soft close controlled shutter for multilayer deposition.

4.9 All sputter guns shall be magnetic as well non-magnetic compatible.

5. POWER SUPPLIES AND ACCESSORIES (of reputed make):

5.1 RF Power supply of ≥300 Watts, 13.56 MHz with both automatic and manual type matching network and other essential items of reputed make. (One No)

5.2 Pulsed DC Power supply: 700 Watts or more, with 40-50 % duty cycle. (One No)

6. **Bake out unit** with temperature regulator for chambers upto ~ 200°C.

7. TARGETS with OFHC Copper baking plate:

7.1 2 inches diameter and ¼ inch thick Targets of Boron, Magnesium, MgO, MgB_2, Aluminium and Al_2O_3 of 4N purity and Niobium of 5N purity with copper base plate (OFC) shall be supplied wherever necessary.

8. MASS FLOW CONTROLLERS: (one for each gas)

8.1 Mass flow controllers for the 5N purity gases – Argon (upto50 sccm)and Nitrogen, Hydrogen and Oxygen- upto 20 sccm shall be supplied.

8.2 Display controller for 4 MFCs simultaneously.

8.3 Stability and control: ≤0.2 sccm.

8.4 Metal sealed and digital MFCs.

8.5 All MFC should have individual shut off valves and ON OFF manual ball valve at both inlet and outlet sides with lowest response time and minimum shoot-up.

9. MASK MANIPULATOR:

9.1 One gear control mask manipulator to accommodate 5 masks.

9.2 It should have the provision to install a mask in front of the sample and the transfer system to exchange mask in vacuum.

9.3 Gap between mask and substrate shall be less than 0.5 mm.

9.4 Provision for adjusting the gear control from outside the chamber is mandatory.

10. GENERAL (for both chambers):

10.1 The system must be capable of achieving uniformity ≤ ± 3-4% across 1 inch substrate.

10.2 All necessary Safety interlocks should be provided.

10.3 Flanges on all ports should have knife edges on both sides cutting into the Copper gaskets on and should be UHV compatible.

10.4 All heating stages shall including PID controller etc.

10.5 All metal gate valves should be UHV compatible from reputed make.

10.6 All components and accessories should be UHV compatible and bake-able.

10.7 Shutter for all targets and substrates and view ports.

10.8 All sputter guns shall be magnetic as well non-magnetic compatible.

10.9 All shutters made of Tantalum/Molybdenum material.

10.10 Suitable instrumental rack on wheels to mount the chambers, vacuum pumps, power supplies and related accessories.

10.11 Provision to lift and open the main deposition chamber for maintenance.

10.12 Provision for purgeline.

10.13 Provision of gas delivery distribution ring to have uniform gas distribution both at the target (magnetron) as well as substrate.

10.14 Complete one pack each of (10 OFHC gaskets) for all ports shall be provided as spares.

10.15 Essential tool kit should be provided with the system.

10.16 Schematic diagram with dimensions of the complete system to be provided.

10.17 Manual of individual components and operational manual of the system to be provided.

10.18 Installation, commissioning, and demonstration (of desired uniformity and base pressures) along with onsite training at NPL New Delhi must be provided.

10.19 Must provide guarantee against manufacturing defects for 12 months from the date of installation.

10.20 All the electrical connections should meet Indian standards preferable single phase ~ 50 Hz and 230 V±10%.

10.21 Vendors should have ISO:9001 or similar certification.

10.22 Original warranty certificate to be provided for all imported items.

10.23 Warranty: 02 years from the date of successful installation.

10.24 Spare parts should be available for next seven years from the date of expiry of warranty.

10.25 Chillers of suitable capacity with necessary lines to supply cold water for RF power supply, DC supply, substrate holder and pumps (if required) shall be supplied separately.

B. OPTIONAL (Each item to be quoted separately): Suitable and Compatible for both chambers-

B1. Residual Gas Analyser (RGA).

B2. Suitable Titanium Sublimation Pump (TSP) to be used with Ion pump.

B3. Thickness monitors compatible with RF power for in situ thickness measurement during deposition with suitable display.

B4. Ultra High VACUUM furnace to reach temperature of 1200 deg C with 10^{-8} mbar.

B5. UPS 10KVA with two hours back time at full load.

B6. One complete set of vacuum gauges for both the chambers as spares.

B7. Fully automated computer control operation.

B8. One oxygen cold cathode gun: One cold cathode ion source with high ion current 50 uA, large sputter area of 1 inch approx, variable ion energy 0-6 keV, used for reactive gases, including power supply and leak valve to connect gas.

B9. RF Power supply of more than 300 Watts, 13.56 MHz with automatic and manual both types matching network and other essential items of reputed make. (One No).

B10. 2″ UHV compatible Magnetron Sputtering Gun- Two Nos, Two RF and Three DC Compatible, Details mentioned as 4 in essentials.

B11. One suitable and compatible RHEED assembly.

B12. Provision for illumination inside the chambers.

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Tender No: 14-VI/SD(799)15-PB/T-126

1. **Dual counter and timer:** for Photon counting system — Quantity 01 (Sd/-)
   Specifications:
   100 MHz or higher counting rate.
   Computer selection of the preset stop value, the time base, the display of A or B counter contents, and the remote mode to lock out operator interface with front panel controls.
   An 8 digit display.
   All frequent used controls are on the front panel.
   Dedicated gate inputs for each of the A and B counters
   Separate overflow outputs for each of the A and B counters.
   Front panel test points for the A and B input discriminators.
   COMM port.
   Options for fully computer control.
   Packaged for mounting in a standard NIM crate

2. **Amplifier and Discriminator:** for discriminating signal pulses — Quantity 01 (Sd/-)
   Specifications:
   Rise time few ns
   Noise about 10 micro volt at highest gain
   Gain few hundred
   Adjustable discriminator threshold from 50 mV to ~ 1 V
   Output at 50 Ohm load from 0 – few hundred mV
   Packaged for mounting in a standard NIM crate

3. **Time to amplitude converter** — Quantity 01 (Sd/-)
   Specification:
   Resolution few ps
   Minimum Start-stop conversion time few ns
   Output max 10 V
   Packaged for mounting in a standard NIM crate

4. **Preamplifier:** low noise for PMT and photon counting unit — Quantity 01 (Sd/-)
   Specification:
   Gain up to 10
   Output at 50 Ohm
   Packaged for mounting in a standard NIM crate

5. **Precision pulse generator** — Quantity 01 (Sd/-
   Specification:
   Positive and negative polarity
   Internal oscillator is synchronized to ac line frequency
   Options for both Internal and external reference voltage
   Possibility of attenuated output at least up to 1000
   Variable rise time of the pulse up to few 100 ns
   Packaged for mounting in a standard NIM crate

6. **NIM crate with power supply** — Quantity 01 (Adv)
   Specification:
   NIM crate for mounting all the above mentioned electronics in one crate
   Power supply with output ± 6 V, ± 12 V, ± 24 V and others voltages for powering up all the above mentioned electronics

7. **Necessary cables for interfacing the electronic units with computers** — Quantity 01
   3-5 m long and compatible with 50 Ohm

Note for purchase – To best of our knowledge there is only one company ORTEC who makes these electronic equipment and within my experience every research groups use them. Their Indian representative is AMETEK Advanced measurement Technology. However to maintain clarity I request for **limited tender with web display** and request to consider the case if single quotation is received in that.

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DETAILED SPECIFICATIONS OF LASERS

1. Diode laser @ 760 nm

- Grating Stabilized Diode Laser System with anti-reflection coated laser diode.
- Design wavelength: 760 nm
- Laser output is optically isolated and coupled with single mode optical fiber with FC/ APC Output power about 50 mW
- Coarse tuning: 0.5 nm
- Linewidth (5 µs): about 100 kHz
- Frequency stability: about100 MHz/K .
- Mode hop-free tuning: about 30 GHz
- Control amplifier for reducing the amplitude noise and enabling faster frequency scan
- Required controllers like current control, temperature control units
- Controlling and scanning of unit for piezo
- Computer interfacing unit
- 19" rack box for housing all electronics
- All required cables
- 220V-50 Hz Indian standard input

<u>OPTIONAL :</u> Spare piezo and spare laser diode for 760 nm

2. Fabry-Perot cavity:

- Fabry-Perot-Interferometer for wavelength range 650 - 940 nm
- High finesse at 760 nm and may be lower finesse at higher wavelength will be acceptable
- Control and scan unit
- Required cables
- 220V-50 Hz Indian standard input

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