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Technical Specifications for Inductively Coupled Plasma Mass Spectrometry (ICP-MS)

Sr. No.	Specifications	Requirements	Compliance (Yes/No)	Additional information
1	Mass Range	4 - 260 amu or better		
2	Scan Speed	3000 amu/sec or better		
4	Auto sampler	Shall have fast, accurate and flexible sampling capacity. Capacity minimum 180 samples Number of Vials of suitable capacity – 1000, along with corrosion-resistant components should be supplied with cover.		
5	Sample introduction	ICPMS should be quoted with a glass concentric nebulizer, spray chambers, quartz torch for efficient matrix decomposition, sample ionization, and quartz injector. Suitable to use with aqueous, organic and HF and high TDS sample Peristaltic pump: It should have high precision minimum 3 channel computer controlled variable flow rate. Nebulizer: It must include a PFA nebulizer having high resistance to corrosive acids such HF. Spray Chamber: A Peltier-cooled, temperature-controlled quartz spray chamber (1 No). The Peltier temperature setting can be user-defined in the range of -5 to +20 °C or better.		

		<p>High Matrix Capability: The system should be capable of analyzing percentage level, ppm, ppb and ppt level in a single run. The system should be able to handle all types of samples ranging from clean water samples to high matrix samples with TDS ranging up to 20% or more with provision for direct aspiration without any need to manually dilute the sample.</p> <p>Argon gas dilution accessory to aspirate >20% TDS samples</p> <p>The vendor has to quote all required accessories to address high TDS.</p> <p>The sample Introduction system should have a very low dead volume with a low uptake rate (0.25 ml/min or better) to reduce the waste generation.</p> <p>The sample introduction system, torch & cones should be easily accessible. Cones should be made of Nickel or platinum.</p>		
6	Ion source RF Plasma	<p>Solid-state digital RF generator 27 MHz or higher, variable power from 500 to 1600 W or better for automatic control of torch ignition, system warm up and shutdown</p> <p>Shall be significantly stable for varying sample matrix</p> <p>Single-piece torch featuring quick dismount and remount fitting for easy maintenance</p> <p>The 3-axis position shall be fully adjustable under computer control</p> <p>Auto shut down after completion of analysis</p> <p>Plasma gas control should have at least 4 active flow controllers for control of plasma, auxiliary, makeup & carrier gases. The plasma should be fully controlled through PC of horizontal, vertical and sampling depth for maximum sensitivity and minimum polyatomic interference.</p>		

		Autotune facility/plasma view to optimize plasma conditions, lens and cell voltage, etc. for best ionization and sensitivity.		
7	Plasma Mode	Shall have cold and hot Plasma modes.		
8	Mass flow controller	Electronic high efficient mass flow controller for gas flow controlling.		
9	Interfaces	<p>Sampler, and skimmer cones/extraction systems should be easily mountable and demountable. The cones should be accessible without breaking the vacuum for easy maintenance. Systems which can access the ion lenses without breaking vacuum will be preferred as it will reduce the instrument downtime after routine maintenance or services. Cones should have larger orifice (> 1mm) to minimize clogging.</p> <p>Suitable water-cooled interface under vacuum and with standard high-performance Ni and Pt sampling and skimming cones. A lens/cons system outside the vacuum system is preferred to reduce downtime.</p> <p>4 sets of Nickel and 2 sets of Platinum cones (skimmer and sampler cone) should be supplied extra.</p> <p>The ion optics and extraction system should provide high ion transmission across the entire mass range. Ion focusing should be capable of minimizing interface background (≤ 2 cps in no gas mode).</p> <p>Ion focusing system should be capable of removing all neutrals and photons from the ion path without causing any damage to the optics. The system should be capable of minimizing the interface background.</p> <p>The system should have the least maintenance components. The vendors have to give a maintenance chart for all the components that require frequent maintenance or replacement of consumables.</p>		

10	Vacuum system	<p>A robust efficiency vacuum system with 3 or more vacuum stages and minimum maintenance and utility with low noise level.</p> <p>The pumps should be a fume and acoustic-free system.</p> <p>Safety mechanism against power failure. (Specify).</p> <p>Vacuum oil should be additionally for refilling.</p>		
11	Quadrupole	<p>The quadrupole mass filter should be stable and provide a resolution of 0.3 amu or better.</p> <p>The analyzer quadrupole must have the ability to discretely control the resolution of selected mass regions dynamically, without affecting the overall nominal resolution of the system for non-“custom-controlled” mass regions.</p> <p>The Mass range should be from 4 - 260 amu or better to allow the analysis of radioactive elements & Actinides.</p> <p>The Dwell time should be better than 0.1 ms (both pulse count and analogue modes) for the fastest settling.</p> <p>Quadrupole material: Made of molybdenum/SS or better for a very low coefficient of thermal expansion.</p> <p>Scan speed >3000 amu/s</p> <p>The analyser must have the ability to discretely control the resolution of selected mass regions dynamically without affecting the overall nominal resolution of the system.</p> <p>Quadrupole driven by digital RF generator (2 MHz or higher)</p> <p>Quadrupole with High Mass and Low mass off feature</p> <p>Quadrupole supply and replacement should be included in the warranty</p>		
12	Resolution & Stability	<p>0.4 amu or better</p> <p>ICPMS system should have good stability performance, bidders to enclose copy of their qualification stability test as concept of proof.</p>		

		Mass stability of + 0.05 amu over 8 hrs or better Short term stability 3% RSD or better over 10 mins Long term stability 3% RSD or better over 120 mins Short term and long term Mass stability (specify)										
13	Gas control	System should have dedicated MFC devices to control plasma, auxiliary, nebulizer, reaction gas and collision gas.										
14	Sensitivity	Sensitivity should be capable to quantify from ppt level to high ppm levels without dilution. Specify sensitivity at minimum 3 mass level <table><tr><td>Level/Element</td><td>cps/mg/l</td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr><tr><td></td><td></td></tr></table> Specify IDL @ n=10, multi-element, integration time -5s.	Level/Element	cps/mg/l								
Level/Element	cps/mg/l											
15	Background Equivalent Concentration. (BEC)	Background equivalent concentration should be less than 1 cps (Specify)										
16	Background noise ratio	1 cps or less (Specify)										
17	Oxide ratio	CeO/Ce (%) - 2% or better (Specify)										
18	Doubly charged ratio	Ba2+/B+ - 3% or better (Specify)										
19	Isotope ratio precision Ag107/Ag109	0.1% RSD or better (Specify)										
20	Cell Technology	System should provide with a Cell technology to remove polyatomic & Isobaric Interferences. The system should have all the three modes of operation: Standard, collision (using inert gases such as helium) and reaction mode for trace										

		<p>level detection and for effective removal of interferences from complex sample matrix.</p> <p>ICPMS systems prefer to have dedicated gas channels with MFC for suitable gases or gas mixture for trace level detection and for effective removal of interferences from complex sample matrix.</p> <p>The system should be capable of performing mass shift mode/proton shift or equivalent technology and the vendor should attach appropriate application note to demonstrate the technology. The system should be very effective in removing unwanted polyatomic interferences formed due to free atoms.</p> <p>The gas switching time & stabilization time of the collision and reaction cell from no gas to inert and/ or reaction gas is to be specified and to be demonstrated during technical evaluation.</p> <p>The Reaction cell System must work Low & High Mass cut off facility to take out freshly formed poly atomic interferences.</p>		
21	Dynamic range	9 orders of magnitude or better		
22	Operating modes	Please specify the optional modes.		
23	Detector	<p>1.The ion detector should be simultaneous discrete dynode electron multiplier, and allow element concentration calibration over a full 9 orders magnitude of dynamic range in a single scan using both analog and pulse ion counting mode.</p> <p>2.The data acquisition rate should be 2000 amu/sec or more.</p> <p>ICPMS should have high data acquisition rate to address Nano particle applications.</p> <p>3. Life time (specify)</p>		

		Detector supply and replacement should be included in warranty		
24	Standard solution traceable to NIST or its subsequent equivalent'	100 ml 1000 ppm ICP MS Standard solutions NIST traceable certified reference solutions for Al, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, Zn, Tl, Te, Sr, Se, K, Li, Mg, Mn, Na, Ni, Pb, As, Hg, Mo, P, Y, Ag, Au, S, Si, Sc, In, Cs, Rb, Sb, Zr, Sn, Ti, V, W, V, Pd, and Gd Multielement standard solution (wherever possible) is preferred and rest of the elements as single element standard solution. Required Internal standard and instrument baseline control standards		
25	Torch and Nebuliser	Shall provide additional number (2 nos each) compatible torch and nebulizer. Please specify. Mini Torch not acceptable.		
26	Gas Generator/Gas cylinders	Suitable gas generator /cylinders (two for each) with suitable regulators for each type of gases/gas mixture. Necessary gas purification system and gas switching manifold should be included		
27	Argas consumption (Litre/min)	Detail should be provided for low and specify for standard and high TDS application		
28	Computer platform	Suitable branded computer, i5/i7 processor with minimum 12 GB RAM Memory, Intel chipset, 1 TB HDD, DVD-RW, additional LAN port, 23" LED monitor with suitable original latest windows based 32/64-bit operating system, with MS Office. (with Original CD), LaserJet printer.		
29	Quantification software System/Software	The Vendor should quote IQ/OQ/PQ for the ICPMS system LIMS compatibility Software for batch analysis. Perpetual software updates shall be provided free of charge as and when available. Windows-based latest version of software with perpetual license		

		<p>capable of controlling all aspects of Mass Spectrometer, having following features:</p> <p>software that guides users through the method and sequence development, and method templates for the rapid development of commonly used methods.</p> <p>On-line help with quick steps to reference entire instrument user manual</p> <p>Software must have inbuilt methods available for routine samples to enable fast turnaround time after installation and commissioning.</p> <p>The software also should have facilities for exporting data to excel or equivalent for easy processing.</p> <p>Quantitative analysis includes external calibration, addition calibrations, a method of standard additions, isotope ratios and isotope dilutions and semi-quantitative analysis.</p> <p>Calibration for multi-element external calibration, a method of standard additions, and isotope ratios.</p> <p>Data reprocessing on stored data without re-running samples for changes of calibration points, internal standard points or curve fit mode.</p> <p>Editable auto-sampler rack and tube positions</p> <p>Fully automated instrument initialization (start-up) routine, including instrument stabilization time, plasma X/Y position adjustment, mass calibration, and quadrupole resolution</p> <p>Simultaneous real-time graphical display of signal as full mass scan, segments of the mass scan, and signal response vs time for multiple isotopes or ratios.</p> <p>Software should have Remote diagnostics and LAN connectivity.</p>		
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30	Uninterrupted Power Supply(UPS)	True online UPS of suitable capacity with power factor correction and harmonic distortion (< 5 % THD; < 3% Single Harmonic), Three phase input and 440V for the smooth running of ICP-MS with tubular battery (Brand-Panasonic/ Exide /Ameron/or any other substantially equivalent) with back up of 45 min. (Brand APC/Emerson/Numeric or any other substantially equivalent). Please specify the name of brand.		
31	External Accessories	Exhaust system with flexible metallic bellows and required accessories, drain, waste drum.		
32	Spares/ Consumables	The system should have the least maintenance components. Vendors have to give a maintenance chart for all the components that require frequent maintenance or replacement of consumables. Consumables for running 1500 samples should be included in the bid.		
33	Training	Maintenance and application training of 7 days at IIT Bombay must be provided for 15 people, free of cost. Additional onsite Application/Maintenance training should be provided after installation.		
34	Nano particle and single cell detection	ICPMS should be capable for doing single particle, Nano particle and single cell detection applications. Any hardware and software required for this to be quoted. Technical documents for the same are also to be attached in technical bid.		

TERMS & CONDITIONS				
1	Model and year of introduction of the instrument	Shall be mentioned in the tender along with original brochures /catalogue. Though the specifications given are basic and general in nature, preference will be given for the selection of the latest higher-end versions. Therefore, bidders are advised to quote for different models.		
2	Place of installation	Gogri Hub for Membranes Research, IIT Bombay		
3	Warranty	<p>5 years comprehensive warranty from the date of completion of installation for the complete system including replacement of instruments and parts, spares, accessories and labor charges. Complete set of spares and consumables as stand by shall be provided/made available along with the equipment or from time to time during the period of warranty. The repair/servicing and periodic IPV (Instrument Performance Verification) of the equipment with traceable standards have to be carried out by the manufacturer/supplier free of cost during the entire warranty period or extended warranty period irrespective any number of repairs / services.</p> <p>Definite time schedule for servicing of equipment, time required for attending break-downs, etc shall be indicated in the terms & conditions for warranty.</p> <p>Shall provide good after sale service/technical support capable of attending on short notice at places where the equipment is installed. At least 2 preventive maintenance visits and unlimited</p>		

		breakdown calls by the service/application support engineer during the warranty period, every year.		
4	After sales service	<ol style="list-style-type: none"> 1. Shall provide for annual maintenance contract / after sales service contract after the warranty period. 2. Definite time schedule for servicing of equipment, time required for attending break-downs, etc shall be indicated in the terms & conditions. 		
5	Training of personnel	Basic/required training (not less than five days) and troubleshooting training to be imparted to the satisfaction of laboratory officials		
6	Experience	The supplier shall have experience of at least 3 installations and operation of the equipment in IITs or other prestigious institution in India, including the model quoted		
7	Specification sheets	Detailed specification sheet(s) highlighting all the technical and other specifications must be attached.		
8	Users List	Complete list of users in India for the equipment (inclusive of the quoted model) along with certificates/testimonials from the customers shall be enclosed.		

9	Instrument Performance Verification (IPV) (IQ, OQ & PQ)	As per the specified standards applicable with documents		
10	Installation Check out specification.	Shall be provided by the supplier.		