INDIAN INSTITUTE OF TECHNOLOGY BOMBAY

MATERIALS MANAGEMENT DIVISION

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Technical Specifications of Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES)

Sr. No.	Item Description and Detailed Technical Specification	Technical Compliance (Yes / No)	Additional Information (if any)
1.	**Instrument Design:** a) The instrument must be a bench-top & compact model. Due to space limitations, floor mounted instruments are not acceptable. b) The instrument must be a Polychromator based simultaneous reading ICP-OES using solid-state detector technology. c) System should have grating with more than 110 lines/mm for higher dispersion & resolution d) An optical system purge gas flow should be of 0.7L/min or less and can use either nitrogen or argon for purging and the gas flows must be controlled by the system controller. e) Gas flow for the Polychromator purge must be Mass Flow Controlled. f) The Polychromator must be Thermostatted at 35°C g) The instrument must be able to simultaneously perform determinations across the entire spectrum, both UV and visible without any changeover. All emission wavelengths need to be read simultaneously h) The instrument must be able to simultaneously determine all desired elements in one analytical reading. i) The plasma must have dual view for major, minor & trace elemental analysis.		

	j) Optical system must be enclosed in a purged and Thermostatted optical enclosure **Optical resolution:** less than 0.007 nm at 200 nm		
2.	**RF Generator:** RF generator must be solid state and have a power output range of 750 - 1500 watts and should be continuously variable & computer controlled. The RF generator must be of free running design and have power transfer efficiency into the plasma of at least 75% to eliminate the need of an inefficient secondary matching network. a) The power output stability must be better than 0.1%. The system must include a water chiller, and that chiller must not be mounted to the instrument chassis and can be situated at a distance from the instrument.		
3.	**Sample introduction system:** a) The instrument must include a glass cyclonic spray chamber and a glass concentric nebulizer. b) The system must be able to accommodate commercially available, specialty nebulizers and spray chambers manufactured by third parties for maximum analytical flexibility. c) The system must include four or more channel peristaltic pump to allow on-line addition of internal standards. Systems with additional channels for adding reducing agent mainly for hydride elements will be required. d) The system should have fully computer controlled, continuously variable speed peristaltic pump >70rpm,		
4.	**Plasma:** a) The instrument should have a vertical plasma orientation, and the torch should not require any alignment & optimization. b) Plasma ignition and shut down must be computer controlled and totally automated c) All plasma gases (plasma, Auxiliary, Nebulizer, Makeup gas or any additional gas) should be continuously variable and adjustable as per matrix & elemental analysis requirements. d) Viewing of the plasma height must be adjustable & it		

	should be computer controlled.		
5.	**Mass flow controllers:** a) All gas flows to control the plasma should have Mass Flow Controllers on them for precise gas flow control. This includes plasma gas (coolant), auxiliary gas, nebulizer gas and make up gas. Vendor must specify number of MFCs provided along with precision for each MFC		
6.	**Tail Plume of plasma:** a) The instrument should not require any additional hardware for removing the tail plume of plasma		
7.	**Detector:** a) Detector should be continuous detector: CID/CCD or equivalent b) The detector must have anti-blooming protection on each pixel c) The system must have the ability to view maximum of the emission spectra for the entire wavelength range. d) Radial viewing height should be fully adjustable for entire viewing range. e) Detector should have minimum read time/ Integration time of 1 second for faster analysis, saving sample, reagents & Ar gas consumption. f) The detector must be cooled by a Peltier device to a temperature of at least -35°C to minimize detector dark current thereby enhancing instrument performance and detection limits. Vendor must specify the gas flow rate required for purging the detector.		
8.	**Instrument calibration:** a) The instrument should not require any extra hardware for recalibration system to monitor system conditions and ensure optical stability.		
9.	**Software:** a) The instrument controlling software must be 64-bit running under Microsoft Windows 11 operating system. b) Methods and data must have flat file data storage. There		

	must also be an option to embrace data storage into database. c) The software must be able to display calibration curves for all the elements analyzed simultaneously. d) The software must be able to display all the peaks from an analysis simultaneously. e) The software must provide automated background correction, whereby the user does not need to decide upon suitable background points for background correction. f) The software must have the ability to do spectral interference correction. Traditional Interfering Element Corrections (IEC) must be available, and the system must be able to calculate these values automatically. g) IEC factors must recalculate automatically when background correction points are changed eliminating the need to recollect the IEC data. h) The system must be able to apply spectral interference correction in addition to background correction post sample analysis, eliminating the need to reanalyze the sample thus increasing productivity. i) The software must allow for four different types of predefined check standards which may be customized by the instrument user. If samples are found to fall out of these ranges, user defined corrective actions including recalibration and rerunning of samples must be available. j) Additional QC capability must include at least three types of blank checks, multiple sample calculations including duplicates and dilution calculations and multiple spike calculations. k) The instrument must be able to read both background and emission data simultaneously and allow for manual or automatic background correction. l) All raw data must be saved, and the system must allow for post run reprocessing of the data including the changing of background correction points, standard values, curve-fit technique, and individual replicate		

	editing. m) Calibration curves must be stored and be able to be recalled for later use. n) The system software must include smart system health tracking with early maintenance feedback and troubleshooting features, including key component counters, timing monitor, system component test and real-time solution flow path display. o) The system software must include both element overrange and internal standard failure reactive dilution options. p) The software must have a library of analytical wavelengths containing number of emission lines whose relative intensities are determined on the instrument optical system. q) Calibration equations must include linear, quadratic and rational and include functions of weighted fit and force through blank options. r) Vendor to specify Ar gas consumption during standby mode.		
10.	**Exhaust requirements:** a) The instrument must be able to operate with a single exhaust extraction directly coupled to the instrument, with minimum exhaust flow requirement. Vendor to specify exhaust flow requirement for their instrument.		
11.	**Warranty** a) The instrument should have a warranty of at least 1 year		
12.	**Flexibility & future upgradability** a) Instruments should be upgradable with dedicated HF resistant kit (dedicated torch, spray chamber, Nebulizer, tubing set) as and when required b) Instrument should be upgradable with hydride generation accessory in future. c) Instrument should be upgradable with dedicated Organic kit (dedicated torch, spray chamber, Nebulizer, tubing set) along with oxygen gas line for reducing soot formation.		

	d) Instrument should be upgradable with autosampler in future e) Instruments should be upgradable with auto diluter in future		
13.	**Local supply** a) Vendor should quote exhaust system, Argon Gas cylinder with dual stage regulator, Gas control panel, 10 KVA UPS with isolation transformer minimum 30 min. backup, with competent PC and Printer.		