

## Technical Specification for Gas Chromatography-Mass Spectrometer

The instrument will be installed at JNPT, Mumbai, and NOT at the IIT Madras campus

### Vendor eligibility criteria

1. A list of at least 3 Institutions/R&D units/Industries where similar instruments have been supplied in India, including contact details (name of the person-in-charge, email, and phone number), should be provided.
2. The quoted model's three performance certificates in reputed institutions in India should be enclosed duly signed and stamped by the concerned scientist.

### Technical specifications:

Sl. No	Component	Specification
1	<b>General</b>	<p>The system should be designed and manufactured under ISO-9001. The chromatography data system should be based on Microsoft Windows operating system for instrument control, data acquisition, and data analysis.</p> <ol style="list-style-type: none"> <li>1. Must be able to configurable at least 2 inlets (mass selective and GC-FID analysis) and 3 detectors.</li> <li>2. Retention time repeatability should be &lt; 0.0008 min, and Peak area repeatability &lt;1 % RSD.</li> <li>3. Integrated leak check function allows you to easily check for leaks and extensive self-diagnosis function with safety features.</li> <li>4. Should perform automated baseline check and user-defined system suitability test in a sequence for standard detectors.</li> </ol>
2	<b>Column Oven</b>	<ol style="list-style-type: none"> <li>1. Provision for a minimum of two suitable capillary columns and can be exchangeable with a packed column with a suitable adapter.</li> <li>2. Temp. Range: Ambient + 4 to 450°C.</li> <li>3. Ramp rate: maximum 100°C/min or more.</li> <li>4. Cooling rate: 450°C to 50°C within 4 min or better with optional cooling ramps.</li> <li>5. Built-in oven light that facilitates column installation should be available.</li> <li>6. Should have oven power safety (power off when the door is open)</li> <li>7. Minimum 10 programmable steps and 9-temperature ramp.</li> </ol>
3	<b>Programmable Split/Splitless injector port – 2 No</b>	<ol style="list-style-type: none"> <li>1. Minimum 2 programmable split/splitless capillary inlet should be provided.</li> <li>2. Maximum temperature: 400°C or more.</li> <li>3. Split ratio: 6000:1 or more.</li> <li>4. Pressure setting range 0 – 145psi with control of 0.001 psi for the whole range. Should have an electronic pressure control.</li> <li>5. It should also be capable of maintaining constant flow or constant pressure of the carrier gas.</li> </ol>

		6. Pressure program ramps: Minimum 3 steps.
4	<b>Flame Ionization Detector</b>	<ol style="list-style-type: none"> <li>1. The minimum detection level should be around 1.2 pgC/s for dodecane or an equivalent compound.</li> <li>2. Temperature range of up to 450°C.</li> <li>3. Able to automatically control up to 3 channels of gas, i.e., H<sub>2</sub>, N<sub>2</sub> make-up gas, and zero grade Air.</li> <li>4. Must have an acquisition time of 2ms (300Hz) or better.</li> <li>5. Must provide fast flameout detection and efficient automatic re-ignition. Dynamic range should be up to 10<sup>7</sup></li> </ol>
5	<b>Autosampler</b>	<ol style="list-style-type: none"> <li>1. Automated liquid sampler with 100 Vials capacity or more. Should be able to inject sample volume 1 to 80% of syringe capacity or better</li> </ol>
6	<b>Single Quadrupole Mass Spectrometer</b>	<ol style="list-style-type: none"> <li>1. Ionization modes: EI &amp; System should have a dual filament design with automatic switching.</li> <li>2. Ion Source temperature: up to 350°C.</li> <li>3. Electron energy range minimum 100 eV or better.</li> <li>4. Mass Range: 1.5 to 1000 amu or better.</li> <li>5. Mass analyzer: Quadrupole should be of solid metal, with pre- rods for matrix elimination or equivalent.</li> <li>6. Vacuum pump: Dual inlet/stage Turbomolecular pump (&gt;250 L/s) Ionization.</li> <li>7. Mass axis stability: ±0.1 amu over 48 hours.</li> <li>8. Mass resolution: Unit mass.</li> <li>9. Detector: Sealed long-life electron multiplier tube.</li> <li>10. Should be capable of handling scan and SIM mode of analysis.</li> <li>11. Scan rate: Minimum 12,000 amu/s or better and should retain sensitivity for all higher scan rate acquisition.</li> <li>12. EI Scan sensitivity: Minimum 1500:1 for 1pg of OFN for the mass m/z 272 using 30 m column</li> </ol>
7	<b>Software</b>	<ol style="list-style-type: none"> <li>1. Suitable software for performing data analyses, calibration, blank correction, data import, export, handling, and reporting.</li> <li>2. Must be able to review quantitative peak identification in a single environment that includes quantitation tables, calibration curves, raw spectra, background-subtracted spectra, ratio plots etc.</li> <li>3. Must have built-in reporting functionality to generate industry-standard reports with the ability to customize report templates as necessary.</li> <li>4. Automatically create SIM from acquired Scan data and optimizing tool for SIM group creation with dwell time for better repeatability and peak profile.</li> <li>5. Instrument acquisition, acquired data analysis and reporting should have been built based on the Retention indices through automated features.</li> </ol>
8	<b>Database and software</b>	NIST 2020 library with license, Library database in CD ROM or equivalent should be provided.
9	<b>Capillary Columns</b>	<ol style="list-style-type: none"> <li>1. The following capillary columns must be provided along with the system.</li> </ol>

		<ol style="list-style-type: none"> <li>2. HP5-ms/DB5-ms or equivalent</li> <li>3. Zebron 5-HT or equivalent</li> <li>4. Heliflex® ATT-35ms (or equivalent)</li> <li>5. Heliflex® ATT-5ms or equivalent</li> </ol>
10	<b>Computer</b>	The PC should meet the minimum requirements such as desktop with the i-5 processor, 8 GB RAM, 1 TB, Windows 10 or better, and 28 inches or more LED monitor.
11	<b>Accessories required</b>	<ol style="list-style-type: none"> <li>1. Gas cylinders for Carrier gas and detector gas should be provided.</li> <li>2. Two-stage Cylinder Regulator with Brass Chrome plated body with S.S. Diaphragm for Carrier gas, and Collision gas should be included.</li> <li>3. Suitable Gas Purification &amp; Control Panel with pressure Regulator for Carrier gas and Collision gas should be provided</li> </ol>
12	<b>Warranty</b>	Minimum 3 years warranty with 2 years free service
13	<b>Items to be quoted optionally</b>	<p><b>1. Automated Thermal Desorption system</b></p> <ul style="list-style-type: none"> <li>• Multiple language Graphical touch screen interface for easy instrument operation</li> <li>• Programmable pneumatic control (PPC) for carrier pressure, desorb flow rate, inlet split-flow rate, outlet split flow rate with linear velocity read-out.</li> <li>• Must cater to the volatility range from C2-C44 Carbon Number.</li> <li>• Should have an internal standard addition facility</li> <li>• Automated sampling of up to 50 tubes</li> <li>• Sample tube temp range 50°C to 400°C</li> <li>• Cold Trap can be cooled to -40°C with Peltier effect, without any need to use liquid nitrogen or liquid CO<sub>2</sub></li> <li>• Trap Lowest Temp - 40°C</li> <li>• Maximum heating rate of cold trap is 40°C/sec and ballistic</li> <li>• Maximum desorption capacity from a single tube is 98</li> <li>• Facility of Tube &amp; Trap Dry Purge</li> <li>• Having facility of trap-clean and trap-test functions, which increase the accuracy of the result.</li> <li>• Facility of Tube conditioning during the run (On-Line Tube conditioning in the system).</li> <li>• Transfer line temperature range is 50°C to 300°C</li> <li>• Back-flush gas flow direction for optimal use of traps with multiple adsorbents during trap heating</li> <li>• Initial check for adequate carrier gas pressure prior to tube loading. Sequence leak and pressure test completed on sample tube and cold trap before every tube desorption.</li> <li>• Have Method Compliance of US EPA TO-14, US EPA TO-15.</li> </ul> <p><b>2. Purge and Trap</b></p>

		<ul style="list-style-type: none"><li>• Have facility for cycle time, purge time, desorb, bake, and cool down.</li><li>• System should have the capability for purging and trapping the VOCs and further able to transfer to GCMS.</li><li>• Autosampler for Purge &amp; Trap having capacity 80 positions or more for 40-mL.</li><li>• 80 Nos. vials or more must be supplied along with the system.</li><li>• Should have the cooling facility.</li><li>• Variable Vial heat control from 35°C to 80°C.</li><li>• Programmable automatic sample dilutions.</li><li>• Foam suppressor feature also to be present.</li><li>• Sample pathway should have inert coating suitable for VOC analysis</li><li>• Should have an electronic mass flow controller for flow rate between 5 and 500mL/min or better.</li><li>• Should be capable of recording pressures for sample logging and automatic leakchecking.</li></ul>
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