

**Supply, Delivery, Installation, Commissioning and Training of a Gas chromatograph (GC) coupled with a flame ionization detector (FID) and a mass spectrometer with quadrupole mass analyzer (MS) - SUP/SD/25/06**

| Items                                    | Specifications Required  |
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| <b>Brand Name</b>                        | Please Specify   |
| <b>Model &amp; year of manufacturing</b> | Please Specify   |
| <b>Country of Manufacture</b>            | Please Specify   |
| <b>Country of Origin</b>                 | Please Specify   |
| <b>1. System Requirements</b>            | <p>The System shall comprise a gas chromatograph with flame ionization detector coupled to mass spectrometer with quadrupole mass analyzer that shall produce analytical data to determine and confirm the composition of volatile samples including essential oils (Extracted from both plant and animal tissues), oleoresins, solvent residues, balms, cosmetic, perfumes and fatty acids to trace levels in ppb to ppt levels. System shall have the following major components:</p> <ol style="list-style-type: none"> <li>1. GC Mainframe with Flame Ionization Detector (FID) couple to Mass spectrometer with quadrupole mass analyzer</li> <li>2. Automated sampler to support liquid injection</li> <li>3. Data management and acquisition Software system</li> <li>4. Suitable columns and other accessories</li> <li>5. Computer with a printer</li> <li>6. UPS with 10 kVA capacity</li> <li>7. Required gas supply with accessories</li> </ol> <p>Electricity requirement should be 230 V, 50 Hz.</p> |
| <b>2. GC Mainframe</b>                   | <ol style="list-style-type: none"> <li>1. Must be able to support at least 2 inlets, 2 detectors and 2 signal acquisitions, which means two available inlets separately connect to two separate columns where two detectors attach separately to those columns</li> <li>2. Must have advanced intelligent self-diagnosis feature. Electrical system, flow control systems and sensors must be fully supported by the operating software.</li> <li>3. Must provide software that monitors GC counters and provides graphic display.</li> <li>4. Upgradability for Detector Splitting System (multiple detection capability), Detector Switching System, and/or Backflush System.</li> <li>5. Retention time repeatability: &lt;0.008% (or equivalent to 0.0008min)</li> <li>6. Area repeatability: &lt; 1% RS</li> <li>7. Self-diagnostic feature with safety features to help prevent unexpected instrument malfunctions.</li> <li>8. Must support LAN communications</li> </ol>                                   |
| <b>3. GC Oven</b>                        | <ol style="list-style-type: none"> <li>1. Operating temperature range: 25°C to minimum of 400 °C</li> <li>2. Oven temperature set point resolution must be 0.1°C.</li> <li>3. Oven must support at least 20 ramps/21 plateaus and negative ramps must be allowed.</li> <li>4. Maximum achievable temperature ramp rate must be 120°C/min.</li> <li>5. Oven temperature program set point resolution for the temperature ramp rate must be 0.01°C.</li> <li>6. Maximum run time of at least 999 minutes</li> </ol>  |

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|                                     | <ol style="list-style-type: none"> <li>7. Oven cools down from 400 °C to 25 °C must be less than 4 mins (under non-specific conditions), with faster cooling speed is preferred</li> <li>8. Temperature stability for &lt; 0.01°C for a 1°C ambient change, ensuring the maintenance of oven internal temperature with respect to external fluctuations.</li> <li>9. Could be Upgradable for the use of cryogenic cooling with CO<sub>2</sub> down to the range of -40°C.</li> <li>10. Could be Upgradable for the use of cryogenic cooling with liquid N<sub>2</sub> down to the range of -80°C.</li> </ol>   |
| <b>4. Inlet (Injector)</b>          | <p><b>Split/Split less</b></p> <ol style="list-style-type: none"> <li>1. Should have at least two independent temperature controlled injector units</li> <li>2. Must be suitable for all capillary columns of 50um to 530um internal diameter.</li> <li>3. Must be able to select carrier and makeup gas types: Helium, Hydrogen, Nitrogen.</li> <li>4. Split ratio range: 0 to 7500 must be available to avoid column overload.</li> <li>5. Maximum operating temperature up to 400°C.</li> <li>6. Efficient gas saver mode built-in to reduce gas consumption during standby without affecting performance.</li> <li>7. Must have electronic septum purge flow control to eliminate carry-over.</li> </ol>   |
| <b>5. Autosampler</b>               | <p>A robotic, fast, high precision and unattended automated sampler capable for liquid injection</p> <ol style="list-style-type: none"> <li>a) Allowing approximately 1.8 mL, liquid sample vials</li> <li>b) Sample vial Capacity – Min 100 vial positions for 1.8 mL</li> <li>c) Syringe size: 0.1 µL – 10 µL</li> </ol>   |
| <b>6. Ion source/ Mass Analyzer</b> | <ol style="list-style-type: none"> <li>1. The quadrupoles should be cleanable.</li> </ol> <p>The mass spectrometer must have Electron Ionization (EI) modes supplied as standard. The system should have provision to be upgraded to house Positive Chemical Ionization (PCI) and Negative Chemical Ionization (NCI) modes and be able to switch between EI / CI mode without changing ion source when both ionizations are required.</p> <ol style="list-style-type: none"> <li>2. It should have a mass range of 1.5 to 1090 amu with unit mass resolution over the entire mass range.</li> <li>3. It should be able to perform calibration manually as well as auto-tune at m/z below 500, molecular weight below 500 Da to obtain accurate mass spectrum for high molecular weight compounds such as halogenated and derivatized compounds.</li> <li>4. The scanning speed capability should be 20,000 amu/sec (single scan). Higher scan rates are preferred</li> <li>5. It should have a fast scan cycles in order to obtain highly precise data for fast GCMS</li> <li>6. The mass spectrometer should have a stability of +0.1u / 48 hours.</li> <li>7. The ion source and transfer line must be independently heated over a user-selectable temperature range:<br/>Ion Source: 150 to 350°C<br/>Transfer Line: 100 to 350°C</li> <li>8. The mass spectrometer must have a dynamic range of 5 x 10<sup>6</sup>.</li> <li>9. It should have high performance synchronous SIM/Scan with automated SIM set up that can convert a full scan method to a SIM or SIM/Scan method. The software must automatically configure the number of SIM group, SIM cycles across the peak and the ions added to each group.</li> <li>10. It should have a SIM capability of up to 60 groups of masses with 120 masses per group may be time programmed.</li> </ol> |

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|   | <ol style="list-style-type: none"> <li>11. The mass spectrometer should employ a mechanism to minimize random noise enhancing the Signal-to-Noise.</li> <li>12. EI scan sensitivity: Signal-to-noise (S/N) &gt; 2000 at m/z 272 amu for 1 pg octafluoronaphthalene (OFN) in EI scan</li> <li>13. Mass resolution – Unit mass resolution</li> <li>14. Evacuation speeds and increases allowable column flow rates.</li> <li>15. The mass spectrometer should have capability to install two narrow-bore/ wide-bore capillary columns into the MS simultaneously in order to eliminate the need to swap columns.</li> </ol>   |
|   | <p><b>FID</b></p> <ul style="list-style-type: none"> <li>• FID detector with auto ignition facility</li> <li>• Flame out detection facility/automatic re ignition</li> <li>• Overheat protection system</li> <li>• Minimum detection limit expressed as minimum mass of carbon passing through the flame per second: &lt;1.4 pg C/s</li> <li>• Dynamic range <math>\geq 10^7</math></li> <li>• Maximum temperature: 400 ° C in steps of 0.1 ° C</li> </ul> <p>Capillary column optimized or adjustable for capillary columns</p>  |
| <b>7. Vacuum System</b>   | <ul style="list-style-type: none"> <li>• Vacuum system should be operated on air cooled turbo-molecular pumps with back up mechanically by rotary pump</li> <li>• Should be able to accommodate GC carrier gas flow upto 6 mL/min</li> <li>• High capacity (&gt; 250 L/s)</li> <li>• Noise reduction cover should be included</li> <li>• Vacuum level indicator should be included in the scope.</li> </ul>   |
| <b>8. Data management and Instrument Software system (System Control)</b> | <ol style="list-style-type: none"> <li>a. The workstation of GC-MS should integrate the control of the entire system, the auto-sampler, the operating parameters of the GC and MS from a single interface.</li> <li>b. The system controller should be able to monitor the system status, RF power, gas supplies, instrument temperatures, electrical systems, vacuum system etc.</li> <li>c. The raw data and peak lists can be exported in standard formats to possibly access software packages from third parties.</li> <li>d. Calibration modes must include external calibration and method of standard additions. Correction options must include background subtraction, blank subtraction and internal standard correction.</li> <li>e. It must have a mechanism to lock retention time to keep an anchor to integrated retention times for the analysis of established compounds in complex matrices assuring reproducibility of same retention time such that no method development is required for the instrument over time.</li> <li>f. It should have a mechanism to scan given fragment ion/ ions in the TIC chromatogram even in ppt level (Facility should be available in the software after running a sample); Displaying mass chromatograms from fragment table in the TIC chromatogram.</li> <li>g. Standard, latest MS spectral libraries: NIST, Wiley (or compatible) and pesticides which contains spectra with structural information, should be provided as reference libraries</li> <li>h. The software must have the ability to automatically search significant compounds against NIST, etc. and many other public and private databases.</li> </ol> |
| <b>9. Accessories and other items</b>                                     | <p>The System shall be supplied with a general consumable kit including standard solutions for system tuning;</p> <p>It should include essential accessories kit containing:</p> <ol style="list-style-type: none"> <li>1. GC capillary columns with ferrules and column nuts- column WAX capillary column 30m x 0.25mm x 0.25<math>\mu</math>m - 02 nos &amp; 5-MS capillary column 30m x 0.25mm x 0.25<math>\mu</math>m - 01 no</li> <li>2. Compatible ferrules and column nuts for column WAX capillary column 30m x 0.25mm x 0.25<math>\mu</math>m &amp; 5-MS capillary column 30m x 0.25mm x 0.25<math>\mu</math>m</li> <li>3. Compatible Glass Liners with compatible o-rings (Split -05 and spliless -05)</li> <li>4. Oil for pump 5 litres</li> <li>5. GC septa -2 packets (50 Nos)</li> <li>6. GC vent trap – 5 nos</li> </ol>   |

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|   | <ol style="list-style-type: none"> <li>7. gold seals for the injection port – 2 nos</li> <li>8. filaments for ion source – 2nos</li> <li>9. 10 syringe (10 µL) for liquid injection for robotic sampler</li> <li>10. Autosampler vials – 300 Nos</li> <li>11. Quadrupole cleaning accessories/ consumables</li> <li>12. Tool kits</li> </ol>  |
| <b>10. Data Systems</b>   | Branded Intel at least Core i7 Processor with a minimum of 3.2 GHz Processor speed, 8 GB RAM, 1TB HDD, CD/DVD RW with a separate graphics card that can support multiple displays with preloaded latest possible version of Windows OS. Monitor with 23.5” for Instrument operation and Data Acquisition.   |
| <b>11. System Installation and Commissioning</b>                              | <ol style="list-style-type: none"> <li>a. The installation protocol must include at least full installation, qualification/performance verification and on-site familiarization.</li> <li>b. During commissioning the supplier should demonstrate the system performance by analyzing the performance check samples and a summary report should be submitted to laboratory with relevant data immediately after commissioning the system and should be submitted as part of the Certificate of Acceptance (CoA)</li> <li>c. Chemicals, reagents and other accessories (including standards, certified reference materials and columns) required for commissioning of the system should be provided by the supplier.</li> </ol>  |
| <b>12. Performance specifications</b>   | <p>Performance specifications (should be tested and demonstrated on-site during installation)</p> <p>Selectivity, Sensitivity, Repeatability and Reproducibility should be proven with data generated by the system installed at the time of commissioning of the equipment. Prove Instrument Detection Limits (IDL)</p> <p>The report for the performance specification should be provided as part of the Certificate of Acceptance.</p> <p>Chemicals and reagents (including standards, kits and certified reference materials) required to prove performance specifications of the system should be provided by the supplier.</p>  |
| <b>13. Operation and application Training, Service Support implementation</b> | <p>The supplier should provide</p> <ol style="list-style-type: none"> <li>1. Training for at least 5 people in the beneficiary sites (10 people in total) on the operation and application of the equipment to be supplied.</li> <li>2. Complete technical support for equipment for at least a period of 12 months. This shall include the following at no extra cost: <ul style="list-style-type: none"> <li>• Vendor to provide service guarantee: should the system require service during the warranty period, vendor must guarantee or replacement of instrument for free.</li> <li>• Vendor to have logistic support to ensure that over at least 95% of the service parts are readily available and upkeep delivery within 24 hours.</li> <li>• The warranty shall commence only upon successful completion of the Acceptance Test or commissioning.</li> <li>• Support will be available on working days</li> <li>• Operator/ software training should be provided at the beneficiaries’ premises immediately after commissioning the GC-MS system. Trained application and operation specialist/consultants must be available for customized on-site training.</li> </ul> </li> </ol> |
| <b>14. Warranty</b>   | <ul style="list-style-type: none"> <li>• System should have 2 years comprehensive manufacturer warranty with maintenance package to be included.</li> <li>• The supplier must specify the equipment parts covered under the warranty and consumables which are not covered under the warranty with reasons.</li> <li>• If in case, the instrument is in out of order during the warranty period, the supplier should provide an extended warranty considering this time period.</li> </ul>  |
| <b>15. Transportation including insurance</b>                                 | <p>Transportation: within 2 months upon receipt of purchase order Shipping at DAP Colombo, Sri Lanka (Incoterms 2010) including unloading as well as insurance during transportation as per Purchase Order template requirement and ToR.</p> <p>Note: full delivery address of the end-user/delivery point will be provided upon Contract</p>   |

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**OPTIONS:**

| Items   | Specifications Required   |
|---|---|
| <p><b>Optional requirements</b><br/><br/>(Quote separately)</p> | <p><b>Autosampler with headspace, SPME and liquid injection capability</b></p> <ol style="list-style-type: none"> <li>1. The headspace autosampler shall be able to puncture and inject 1 vial at the time.</li> <li>2. The model shall have a minimum of 10 vial capacity for both 10 ml and 20 ml headspace vials</li> <li>3. Vial Incubator oven with adjustable temperature and agitation speed</li> <li>4. Incubator temperature should be from 40 to 200 °C in 1 °C steps with agitation and should have capacity for 6 vials</li> <li>5. Agitation with interval shaking up to speed of 2000 rpm should be available. Speed selectable in 1rpm increments.</li> <li>6. Syringe heating setting should be either OFF or from 40 °C to 150 °C in 1 °C steps</li> <li>7. Incubation time range 0.1 to 600.0 min in 0.1 min increments should be available</li> <li>8. Injection speed should be selectable 1 to 100 mL/min, in 1 mL/min increments</li> <li>9. Syringe size should be compatible with 1ml-5.0ml</li> <li>10. Injection speed should be selectable 1 to 100 mL/min, in 1 mL/min increments</li> <li>11. Syringe cleaning should be done with inert gas purging of heated syringe.</li> <li>12. The autosampler should have liquid sample injection capability</li> <li>13. Liquid injection unit shall have a minimum of 50 vial capacity for both 2 ml vials</li> <li>14. Should be compatible with 10µl volume liquid injection syringes</li> <li>15. Liquid injection speed should be selectable from 0.1 µL/sec up to 2000 µL/sec</li> <li>16. Wash Station for 2 different solvents for syringe cleaning should be available</li> <li>17. Autosampler should have the capability for liquid sample injection as well as headspace injection</li> <li>18. Capable of exchanging syringe modules automatically, between liquid injection, headspace (HS) injection</li> <li>19. Autosampler system with XYZ robotic mode with syringe only injection for both headspace and liquid injection should be available.</li> <li>20. Should include Vortexer compatible with sample vials with volume ranging from 2ml to 20ml. Should have agitation speed up to 2000 rpm or better</li> <li>21. Should be compatible with SSL, multimode, on column, and packed injectors</li> <li>22. Control software <ul style="list-style-type: none"> <li>● Shall provide an integrated control of GC and the autosampler system. The autosampler system should be fully controlled through the software without using any external controllers.</li> <li>● Headspace and liquid injection parameter shall be controlled via method dialog</li> <li>● System actuals shall be displayed in conjunction with GC status</li> <li>● Shall have an event log for capturing data</li> <li>● Enhanced control of instrument scheduling parameters</li> </ul> </li> </ol> |
|   | <p><b>Multimode Injector</b></p> <ul style="list-style-type: none"> <li>• Hot/Cold</li> <li>• split/splitless modes (compatible with merlin microseal septa)</li> <li>• Large volumes at least upto 250 µL</li> <li>• Temperature Range (Cryogenic) : at least ( -150 ° C) with Liquid nitrogen</li> <li>• Temperature Range: ambient + 5 to 450 ° C</li> <li>• Ability to program Temperature upto 3 ramps at rate of at least 700 ° C/min</li> </ul> <p>The system should have a mechanism to prevent substances and highly retained substances from dirty sample matrices to foul the column and the system</p>  |
|   | <p><b>SPME Tool compatible for autosampler with headspace, SPME and liquid injection capability</b></p> <ul style="list-style-type: none"> <li>• Suitable SPME tool with SPME syringe should be quoted</li> </ul>   |
|   | <p><b>Add additional GCMS library</b></p> <ul style="list-style-type: none"> <li>• Mass Spectra of Flavors and Fragrances of Natural and Synthetic Compounds with Retention Index (FFNSC 3) latest Wiley library should be quoted.</li> <li>• The feasibility should be clearly stated in the quotation for the existing library FFNSC 3 at ITI (Support system requirement: Microsoft Windows 7, 8, 1., 2 GB RAM, 20GB free drive space Database Compilation 2015, John Wiley &amp; Sons, Inc.</li> <li>• Library should come with open-source architecture</li> </ul>   |

|  | <p><b>Software</b></p> <ul style="list-style-type: none"> <li>• The software written in an open architecture (with source code) format to allow user customization of menu lists and the ability to use user-defined macros and scripts to customize the software operation is preferred.</li> <li>• Customer base for the quoted item or earlier versions of the similar instrument in Sri Lanka including user list</li> <li>• Export facility should be available to transfer GC-MS results to DAT file or other type in addition to PDF</li> </ul>  |                                |                      |                 |                      |                               |  |                      |  |  |                      |  |                      |  |                      |  |
|--|---|--------------------------------|----------------------|-----------------|----------------------|-------------------------------|--|----------------------|--|--|----------------------|--|----------------------|--|----------------------|--|
| <p><b>Service agreement (quote separately)</b></p> | <p>An annual service agreement for 5 years after the warranty period. Please fill the details for the yearly breakdown of service charges, terms and conditions in the following format.</p> <table border="1" data-bbox="440 323 1406 604"> <thead> <tr> <th data-bbox="440 323 722 417">Year from the date of Purchase</th> <th data-bbox="722 323 1203 417">Terms and Conditions</th> <th data-bbox="1203 323 1406 417">Service Charges</th> </tr> </thead> <tbody> <tr> <td data-bbox="440 417 722 449">3<sup>rd</sup> Year</td> <td data-bbox="722 417 1203 449">Specify (Labour charges only)</td> <td data-bbox="1203 417 1406 449"></td> </tr> <tr> <td data-bbox="440 449 722 480">4<sup>th</sup> Year</td> <td data-bbox="722 449 1203 480" rowspan="4">If different from the previous year, specify</td> <td data-bbox="1203 449 1406 480"></td> </tr> <tr> <td data-bbox="440 480 722 512">5<sup>th</sup> Year</td> <td data-bbox="1203 480 1406 512"></td> </tr> <tr> <td data-bbox="440 512 722 543">6<sup>th</sup> Year</td> <td data-bbox="1203 512 1406 543"></td> </tr> <tr> <td data-bbox="440 543 722 604">7<sup>th</sup> Year</td> <td data-bbox="1203 543 1406 604"></td> </tr> </tbody> </table> | Year from the date of Purchase | Terms and Conditions | Service Charges | 3 <sup>rd</sup> Year | Specify (Labour charges only) |  | 4 <sup>th</sup> Year | If different from the previous year, specify |  | 5 <sup>th</sup> Year |  | 6 <sup>th</sup> Year |  | 7 <sup>th</sup> Year |  |
| Year from the date of Purchase                     | Terms and Conditions  | Service Charges                |                      |                 |                      |                               |  |                      |  |  |                      |  |                      |  |                      |  |
| 3 <sup>rd</sup> Year                               | Specify (Labour charges only)   |                                |                      |                 |                      |                               |  |                      |  |  |                      |  |                      |  |                      |  |
| 4 <sup>th</sup> Year                               | If different from the previous year, specify  |                                |                      |                 |                      |                               |  |                      |  |  |                      |  |                      |  |                      |  |
| 5 <sup>th</sup> Year                               |   |                                |                      |                 |                      |                               |  |                      |  |  |                      |  |                      |  |                      |  |
| 6 <sup>th</sup> Year                               |   |                                |                      |                 |                      |                               |  |                      |  |  |                      |  |                      |  |                      |  |
| 7 <sup>th</sup> Year                               |   |                                |                      |                 |                      |                               |  |                      |  |  |                      |  |                      |  |                      |  |

