Request for Quotation

Enq. No.: ACMS/ AU/ 2012-13/ IRMS-1

Sub : Quotation for supply of Isotope Ratio Mass Spectrometer (IRMS) and necessaries sample preparation devices as mentioned below.

With reference to the subject mentioned above, you are invited to submit the quotation in a sealed cover in order to reach us before **March 21st, 2013** in the form of a hard copy and soft copy to the address mentioned below.

The prospective suppliers are required to send quotation in two parts in sealed envelopes, as “Technical Bid” and “Financial Bid”. The Technical Bid should contain detailed technical specification of the product being offered and should not mention any prices. The Financial Bid should include the detailed price quotation clearly including the cost of the equipment, taxes, service charges if any, shipping and handling charges. The two separate and sealed envelopes should be clearly marked appropriately as “Technical Bid” and “Financial Bid”.

Terms and Conditions:

1. Maximum education discount, if any should be offered
2. Validity of quotation should be at least for 60 days
3. Prices should be on CIF and FOB separately (if imported)
4. Prices should include the installation and training cost
5. **Warranty should be for at least three years after installation**
6. Normal payment terms for the Institute will be applicable (90% on delivery of the items and the remaining 10% after satisfactory installation/ inspection)
7. Quotation should carry proper certifications like agency certificate, proprietary certificate, etc.
8. Delivery should be made within 9 months

The soft copy of the model quotation can also be downloaded from our website at http://www.iitk.ac.in/infocell/tender/tendernotice.htm

Kindly send the quotation in sealed envelopes latest by 21stMarch 2013 to:

Dr. AnishUpadhyaya
Head, Advanced Center for Materials Sciences
IIT Kanpur, U.P. 208016, India.
e-mail: anishu@iitk.ac.in

Isotope Ratio Mass Spectrometer (IRMS)

The Stable Isotope Ratio Mass Spectrometer (IRMS) should be a continuous flow (CF) gas-source mass spectrometer with a minimum of three collectors and a magnetic analyser, operating at 230V AC Power, capable of measuring the stable hydrogen, carbon, oxygen and nitrogen isotope ratios in the corresponding gases with a mass resolution of 100 or better. The background vacuum of $<10^{-8}$ Torr should be achievable in less than 6 hours using turbo molecular pumps, and the metal body of the IRMS should be bakeable. Absolute Sensitivity of CO_2 (molecules/ion) should be better than 1200 in continuous flow mode. Fitted with all metal gaskets for ultra vacuum (into the e-9 mbar range) which results in zero contamination in the system, especially for hydrogen work. Ion optics should be suitable for greater separation of ion beams and allows for total spacial resolution of H2 (m/z2), HD (m/z3) and He (m/z) avoiding the need for any secondary ion treatment (filters, lens) that can introduce noise into the system and result in poor precision. Fail save automatic inlet valves to protect the system in the event of power failure or helium pressure loss.

System should be fully controlled by software and on board microprocessor connected thru USB communication to ensure most robust industry standard communication. Data acquisition should be automatic and computer controlled with the necessary user-friendly software.

Analyser:

a) Truly universal Faraday triple collectors for simultaneous collection of adjacent masses in range 28,29,30 - 64,65,66 with no adjustment of collectors or amplifiers. The desired combination of the collectors should be selectable through the software.

b) Asymmetrical extended geometry to give true stigmatic focussing with twice the dispersion of normal geometry with the same radius sector.

c) Shorter path length to decrease ion/molecule interactions and 100% transmission through the analyser and a sensitivity which is in the range of <1000 molecules/ion for CO_2.

d) Design to allow greater tolerance of the known variables of ion optics making the analyser more reproducible and less sensitive to magnet positioning. Suitable for the analysis of light stable isotopes in all the commonly measured gases; H_2, N_2, NO, N_2O, O_2, CO, CO_2

e) Ion source:-	High sensitivity, electron impact, plug-in design
f) Magnet:-	Programmable electromagnet
g) Resolution:-	$m/\Delta m$ = 100 (N_2) 10% valley definition. = 40 (H_2) with large spur option
h) Sensitivity:-	< 1000 molecules per m/z 44 ion < 10000 molecules per m/z 2 ion
i) Abundance Sensitivity:-	(<5 ppm for N_2, <30 ppm for CO_2 and < 1 ppm for H_2 at 4 x10^{-6} mbar in continuous-flow mode)
j) Linearity:-	<0.03‰ / nA at beam intensity of 2 x10^{-8} A for CO_2
k) Sample Consumption:-	0.15 nmols/s CO_2 for 10_nA signal at mass 44 (10^{-2} mol/As)
l) Sample Decay:-	Time for a signal of 2E-8 Amps for m/z 44 to decay to below 2E-10 Amps when the inlet is isolated. Continuous flow mode =30 seconds
m) Vacuum:-	Mass analyser – differentially pumped by turbo molecular pumps (70 L/s) for superior abundance sensitivity, backed by a two-stage rotary pump. Ultimate vacuum of 1 x 10^{9} mbar. Source and analyzer pressures monitored by inverted magnetron gauges. Turbo pumps are of the drag stage design which has a high compression ratio suitable for both He and H_2, to remove the detrimental effect of abundance sensitivity during continuous flow applications and eliminate memory.
n) Bakeout:-	Heaters to be mounted adjacent to the flight tube and inlet arrangement for baking our adsorbed water. Covers should be provided.

o) Other inlets:- Capillary interface to allow the use of continuous flow methods. Should have the provision to be connected to carbonate preparation system and water equilibration system.

p) Ref Gas:- Triple port reference gas system for continuous flow applications. Should include dedicated pneumatic valves and an inlet manifold for up to 3 reference gas bottles.

q) Data acquisition system: Data acquisition system should use state of the art highly stable and linear high frequency converters that produce integral slices with zero dead time and quantisation below the beam statistical noise floor at all signal levels.

r) Software:- Suitable operational software for system control and data handling. Fully compatible with Windows 7 and NT.

s) Electronics:- Flashover-resistant source electronics. Full control and monitoring of all instrument parameters through software and on-board microprocessors.

t) Dimensions: Small footprint 1800 mm long x 600 mm wide x 945 mm high

u) Continuous Flow Performance:

Precision SD for 5 injections of gases at natural abundance. Major beam of 10 nano amps.

Gas	**External Precision** (‰ vs ref)
CO_2 (^{13}C)	0.1
CO_2 (^{18}O)	0.1
N	0.1
SO_2 (^{34}S)	0.1
H_2	1.5

Elemental Analyser for the isotopic and elemental analysis of bulk materials

a) The Elemental Analyser should be a combined Gas/Solid/Liquid elemental analyser and gas purification module which produces clean gas samples for the Isotope Ratio Mass Spectrometer. The EA module should allow samples to be analysed directly by utilizing Dumas combustion for ^{15}N, ^{13}C or pyrolysis for ^{18}O and D.

b) The system should be capable to be further enhanced with the addition of the High Temperature furnace for pyrolysis of samples up to 1500°C.

c) The gas analysis facility of the EA module should be provided with an automated sampling needle and the gas chromatograph part of the module. N_2, CO_2 and O_2 can be analysed at atmospheric concentrations while H_2, N_2O, CO_2 and NO can be measured at elevated levels.

d) The system should be equipped with high quality digital flow and pressure sensors, closed valves configuration to save gas and preserve consumables in the event of a power failure.

e) Two long-life furnaces capable of operating to 1100°C i.e. both furnaces should be used for pyrolysis, combustion or reduction applications.

f) On-board microprocessor for storage of furnace temperatures and valve status (guards against PC failure or temporary detachment).

g) Total software control of the instrument system and data processing. Should allow storage of sample analysis protocols to comply with good laboratory practice. Stand by mode to preserve consumables' life during periods of low use. Inter-file import/export facility from instrument PC to laboratory server or internet (allows rapid updating of software or transfer to common spreadsheet packages). Should be fully compatible with Windows 7 operating software.

h) Software controlled oxygen injection to match sample requirements thereby preserving the life of the consumables.

i) Re-chargeable water and carbon dioxide chemical traps. CO_2 trap should be switched in/out of line by software to avoid leaks on changing analytical mode.

j) Gas sampling from septum sealed containers by the original continuous flow flushing method.

k) Purge facility on needle to prevent sample carryover. Full automation via a software controlled autosampler that can accommodate 200 x 12 ml septum sealed containers.

l) Design:-	Bench top Pyrolysis/Dumas combustion unit with vertical mounted furnaces. Built in pressure and flow sensors, isothermal GC and software controlled variable oxygen input.
m) Analytical Mode:-	Samples in capsules should be converted to N_2, CO_2, CO, and H_2 by combustion or high temperature pyrolysis.

n) Combustion/Pyrolysis

1. Furnace:-	Operating range, ambient to 1100^{o}C.
2. Reduction Furnace:-	Operating range, ambient to 1100^{o}C.
3. Column Oven:-	Operating range, ambient to 250^{o}C (isothermal).
4. Combustion Packing Standard:-	Chromium Trioxide, Copper Oxide and Silver wool
5. Water Removal:-	Re-chargeable magnesium perchlorate trap.
6. CO_2 Removal:-	Re-chargeable Carbosorb trap. Software selectable.
7. Gas Control:-	Gas flow rates controlled by crimps. Software controlled oxygen pulse for efficient and economical combustions. A software controlled flow diverter valve selects the GC effluent to go to the mass spectrometer or to waste. Closed solenoid valves to prevent gas wastage during laboratory power cuts.
8. Referencing:-	References of known isotopic and elemental composition are placed in the auto sampler carousel as for normal samples. Option to use reference gas injection at mass spectrometer.
9. Gas Sampling Method:-	Total or partial flush of septum sealed containers. Should have needle purge facility.
10. Sample Range:-	Solids/Liquids:- 5 to 1000 µg O, 50 to 1000 µg H, 5 to 1000 µg N, 5 to 2000 µg C, (NB. samples down to 0.5 µg can be measured with reduced precision). Gases: 0.1 to 100% v/v (CO_2, N_2, H_2, O_2,NO, N_2O)
11. Analytical Cycle:-	4 min per sample (^{15}N only) 7 min per sample (^{15}N and ^{13}C) 4 min per CO_2 gas sample
12. Autosampler:-	66 position pneumatic auto sampler that takes capsules with dimensions up to 12 x 6mm. Software controlled.
13. Dimensions:-	770mm wide, 520mm deep, 555mm high
14. Pyrolysis Option:-	Glassy carbon grit packing. Molecular sieve 5A packed GC column.
15. External Precision	

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Gas	Reference Gas (‰ vs Ref) (10 Nano amps)	Combusion/Pyrolysis (‰ vs Ref)

CO (^{18}O)	0.1	0.5 (100 µg*, n=5)
H_2 (^{2}H)	1.5 3.0 (0.5 ml equilibration)	3.0 (200 µg*, n=5)
N_2 (^{15}N)	0.1 0.1 (12ml of air)	0.2 (100 µg*, n=5) 0.8 (5 µg*, n=5)
CO_2 (^{13}C)	0.1 0.2 (125 ml of 360 ppm) 0.5 (12 ml of 360 ppm) 0.1 (0.1 mg $CaCO_3$)^x 0.2 (0.03 mg $CaCO_3$)^x	0.1 (100 µg*, n=5) 0.3 (5 µg*, n=5)
CO_2 (^{18}O)	0.1 0.2 (0.1 mg $CaCO_3$)^x 0.3 (0.03 mg $CaCO_3$)^x 0.1 (0.5 ml equilibration)	NA

n= 5 samples
* denotes amount of element per capsule
^{x} Reaction of $CaCO_3$ with phosphoric acid in gas container

16. Autosampler **:** XYZ gas auto sampler with changeable sample racks for septum sealed bottles.

17. Heater block **:** Thermostatically controlled block for Auto Sampler. To accommodate 2 x 110 5ml containers, designed to operate at 60ºC ±1ºC.

Automated Carbonate preparation system

a) The carbonate preparation system is for the automatic measurement of carbon-13 and oxygen-18. The stable isotope signatures of carbonates are to be analysed by individually dosing samples with orthophosphoric acid and measuring the resulting carbon dioxide. Precise temperature control and integration should provide ultimate precision of stable isotope analysis. The whole instrument system is driven by Windows compatible software for ease of operation and networking capability.

b) 40 sample carousel for individual acid dosing to avoid problems of ‘memory’.

c) System is housed in a programmable oven that can be operated at up to 90^{O}C for more reticent samples.

d) All acid wetted parts in KEL-F or glass to ensure highest purity analysis

e) Dedicated cryofocussing trap for CO_2 and cold loop cooled by cryoprobe to remove water vapour.

f) Dedicated high vacuum via turbo molecular pump to ensure transfer lines are kept clean and at lowest possible vacuum.

g) Control software is integrated to the system software to allow use of micro cold finger for small samples and call up of stored methods for different sample types.

h) Should be capable of analysing samples down to 5ug.

i) Design:-	All essential reaction parts should be in a precisely temperature controlled oven. Individual acid dosing, dedicated cryofocussing and dedicated vacuum pumping.
j) Autosampler:-	40 sample stainless steel carousel.
k) Temperature Control:-	Thermostatically controlled reaction oven housing all critical components. Designed to operate up to $90^{o}C \pm 0.5^{o}C$.
l) Sample Containers:-	Re usable quartz or borosilicate reaction vessels.
m) Sample Range:-	5mg to 50μg carbonate.
n) Wetted Parts:-	Manufactured from KEL-F or quartz glass.
o) Water Removal:-	Cryogenic loop to prevent transfer of vapour to the mass spectrometer inlet.
p) CO_2 Focusing:-	Liquid nitrogen cooled trap.
q) Vacuum Transfer:-	Dedicated turbomolecular pump (70 L/s) and pressure transducer for monitoring reaction/gas transfer.
r) Software:-	Proprietary operational software for system control and data handling. Fully compatible with Windows XP and 7.
s) Dimensions:-	1200 mm long x 650 mm wide x 800 mm high.

Spares / Consumables:
Quotation should include prices of full sets of spares and consumables for 3 years for the instrument and all the associated peripherals and accessories. Consumables for 3000 analysis should also be included.

Gas Supplies :
Quotation should include prices for all the necessary Gas Supplies with cylinders, Fittings, Regulators, Purifiers, Panel, Plumbing etc. UPS of 10 KVA with 2 hrs SMF

batteries complete with battery rack, cables, inbuilt isolation transfer should be supplied along with the system.

Training :

a). Comprehensive hands-on onsite training for the operators in preventive maintenance, operations and application software of the instrument after installation.

b). An application related training for one person for 10 working days at the manufacturer’s factory site, should also be arranged by the vendor, in operation, maintenance and application of the system.