Indian Institute of Technology, Delhi
Centre for Energy Studies

NOTICE: INVITING QUOTATION

Date: 30.11.2012

Due date: 21.12.2012

Sealed quotations are invited for an item **"Combustion Analyzer for Internal Combustion Engines"**. The quotations for the item should be submitted in a sealed cover (separate bids: technical and commercial) to Dr. K. A. Subramanian, Assistant Professor, Room No. 414, Block V, Centre for Energy Studies, Indian Institute of Technology Delhi, Hauz Khas, New Delhi-110016 on or before **21.12.2012 (Friday)**. The late submission will not be entrained.

The item "Combustion Analyzer for Internal Combustion Engines" comprises of major components such as (i) In-cylinder pressure sensor, (ii) Crank angle encoder, (iii) Charge amplifier (iv) Data acquisition system (v) Post processing online software. The detailed specifications of each individual component of the item are given below.

Item Name	**Combustion Analyzer for Internal Combustion Engines**	
Component (i): In-cylinder pressure transducer		
S.No.	**Parameter**	**Description**
1	Sensor Type	Piezoelectric Sensor
2	Dynamic Pressure Measuring Range	$\geq$ 250 bar
3	Overload	$\geq$ 300 bar
4	Sensitivity (nominal)	$\geq$ 40 pC/bar
5	Acceleration sensitivity	$\geq$ 0.0005 bar/g
6	Linearity	$\pm$ 0.3 to $\pm$ 1% FSO
7	Natural Frequency	20 to 100 kHz
8	Thermal Shock Error	$\leq$ 3%
9	Operating Temperature Range	$\geq 350^0$C
10	Mounting thread diameter	M8×0.75
11	Cooling Type	Un cooled or water cooled
12	Piezo-input cable, O-rings (washers), Sealing material, Couplings should be supplied.	
Component (ii): Crank angle encoder		
1	Speed	Up to 20 000 rpm
2	Permissible load	500g (overload 1000g)
3	Sensing Type	Optical pickups for angle measurements

4	Mounting Type	On flywheel shaft of the engine
5	Resolution	≤ 0.5 degree Crank Angle ≤ 0.1 degree Crank Angle with soft ware
6	Mass load on crank shaft	≤ 500g
7	Humidity	10 – 90 % RH
8	Permissible ambient temperature	– 40°C to +120°C
9	Operating voltage	100…. 300 V AC, 50-60 Hz (or) 11…12 V DC
10	Output Interface	RS 232 or RS422, TTL Up to 0.025 deg CA
11	Flanges, adaptors and necessary mounting items should be provided.	
12	Crank angle encoder and pressure sensors must have high mechanical, vibration and temperature resistance.	
Component (iii): Charge amplifier		
1	No. of Channels	Minimum of 2 channels (Charge and/or voltage signals)
2	Measuring range	Minimum of 400 bar with a sensor sensitivity of 40 pC/bar
3	Resolution	Minimum of 12 bit
4	Linearity error	≤ 1% FSO
5	Drift compensation	Continuous or cyclic
6	Drift	<±0.2 pC/s
7	Low-pass filter	12 kHz, 50 kHz or 100 kHz upper cut-off frequency
8	Hum and noise	< 1 mV RMS or 10 mV PP (0 to 50 MHz)
9	Operating temperature range	0 ... 60 °C
10	Output signal	-10 V … 10 V on BNC sockets; Offset: 0 V or -8 V
11	Power supply	9.5 V ... 36 V DC or 100 V … 240 V AC via included AC adapter
Component (iv): Data acquisition system		
1	Analog input channels	Minimum of 2 channels
2	Digital input channels	Minimum of 2 TTL inputs
3	Digital output channels	Minimum of 2 TTL outputs
4	Amplitude resolution	Minimum of 14 bit
5	Sampling rate	0.5 to 1 MHz per channel
6	Input range	±10/12V
7	Temperature range	Up to 50°C
8	Power supply	100…. 300 V AC, 50-60 Hz (or) 11…12 V DC
Component (v): Post processing software		
1	The software should facilitate integration of all the items ((i), (ii), (iii), (iv)) of the combustion analyzer.	

2	It should facilitate post processing of the acquired signal from the data acquisition which has input signal from pressure transducer through charge amplifier and crank angle encoder. The system should have flexibility of storing and monitoring of the acquired and processed data in a personal computer.	
3	It should have interface with Personnel Computer (PC) in form of Excel data sheets Predefined diagrams, Tables or Statistics including calculations and easy access to acquired data.	
4.	Software should capable of process/calculate/represent the following combustion parameters either online/offline: a) P-θ diagram b) P-V diagram c) Heat release rate d) Mass Fraction Burnt e) Maximum Heat Release Rate f) Cumulative heat release g) Cycle based data h) Average cycles data	
5.	Software should consist of online monitoring of P-θ diagram and heat release diagram.	
	Other details	
1	Engine power	Analyzer should work for Spark Ignition /Compression Ignition Engine in the power range of 0 – 50 kW.
2	Extra accessories	Power supply adaptors, Connection cables, BNC-cables, Ethernet Cable, Clamps, etc.
3	Operating Conditions	The analyzer should be compatible with both automotive diesel and gasoline engines with various power rating.
4	Warranty	1 Year standard warranty and 2 Years extended warranty.
5	Certification	The analyzer should be certified by the National/International agency.
6	Calibration	Calibration charts and supporting documents should be supplied.
7	Any proof (PO/Invoice) of past selling of the similar analyzer to at least two OEMs should be provided.	
8	The whole combustion analyzer unit comprising of all components must be supplied by one supplier only.	
9	Analyzer should be compatible with any other system.	
10	The item should be quoted as single item of "**Combustion Analyzer for Internal Combustion Engines"**. It is desirable that each component shouldn't be quoted separately.	

Terms and conditions covering submission of quotations

1. Please submit the TECHNICAL and FINANCIAL bids in two separate sealed envelopes. Mark clearly as "Technical Bid" and "Financial Bid" on the respective envelops. Both the sealed envelopes should be sent in a single sealed envelope, with clearly marked as "Quotation for "**Combustion Analyzer for Internal Combustion Engines**". The quote should reach the following address on or before **21.12.2012(5:30 PM).**

Name: Dr. K. A. Subramanian
Address: Room No. 414, Block V, Centre for Energy Studies,
Indian Institute of Technology Delhi, Hauz Khas, New Delhi-110016

2. Please quote prices of imported items preferably at FOB (Freight on Board) IIT Delhi inclusive of all taxes, freight, delivery, installation and onsite training charges. The quotation should provide the total price of the system including all taxes and transportation charges.

3. Quote should be in Indian Rupees as well as US Dollars and to be valid for at least three months.

4. Attach all the technical literature and a list of similar installations done in India.

5. If the quote is being submitted by the representative of the principals/manufactures themselves, a valid Agency ship/Dealership Certificate authorizing the agent to quote to IIT Delhi on behalf of the Principals should be enclosed.

6. Complete set of manuals for the operation and servicing of equipment should be given. All circuit diagrams, other mechanical and electrical schematics must be provided to main unit, sub systems and accessories.

7. Spare set: A complete set of necessary spares and consumables should be supplied for at least three years of trouble free operation.

8. Clearly specify the installation requirement such as space, power, frequency, environment (Temperature and humidity), etc.

9. If the items quoted are proprietary in nature, please enclose proprietary certificate from the principals stating "certified that _____ is a proprietary item of M/s. _____ and no other manufacture make these items".

10. If the bidder is Indian agent, the agency certificate should be enclosed.

11. Please produce compliance certificate for the specification.

12. Delivery period: Within 1 month from the issue of supply order.

13. Authority of IIT Delhi reserves the right to reject any or all quotations without assigning any reasons.

14. Validity of quotations: Quotations will be considered valid for 3 months from the date of receipt unless otherwise stated.

15. Correspondence: No correspondence regarding acceptance or rejection of a quotation will be entertained.

16. Samples: Samples when asked for will invariably be made available and sent along with the quotations.

17. Method of submission: Quotations should be sent in a sealed cover, indicating of OUR N.I.Q. REFERENCE NUMBER AND DUE DATE FOR OPENING as otherwise these will not be considered.

    The envelope must contain two SEPARATE bids:
    (i) Commercial bid
    (ii) Technical bid

18. Rejection: The quotation not conforming to the set procedures mentioned above will be rejected.

19. Discount/Rebates: Special discount/rebate wherever admissible keeping in view that the items are being supplied to an Educational Institution of National importance may be indicated.

20. Excise duty (ED) exemption certificate will be provided by IIT Delhi.

Prof.T.S.Bhatti	Prof. M.G.Dastidar	Dr. K.A. Subramanian	Dr.Vamsi K.Komarala
Chairman	Member	Member	Member