



DEPARTMENT OF CIVIL ENGINEERING  
**Indian Institute of Technology Madras**  
I.I.T.P.O., MADRAS-600 036

Form for Inviting Quotations

Ref. No. CE/STORES/2019/PIYS/AUTOMATIC TITRATOR

Tender Starting Date: 17.02.2020 @ 5.00 PM

**DUE DATE: 03.03.2020 @ 3.00 PM**

Tender Opening Date: 03.03.2020 @ 4.00 PM

To

Dear Sir,

1. Quotations are invited in duplicate for the various items shown below / overleaf / **Enclosed list**.
2. **The Quotations duly sealed and superscribed on the envelope with the reference No. and due date, should be addressed to the undersigned and contain in 2 bid system i.e. Technical bid and Commercial bid in two separate envelopes should be enclosed in a single envelope only so as to reach on or before the due date stipulated above.**
3. The Quotations should be valid for ninety days from the due date and the period of delivery required should also be clearly indicated.
4. If the item is under DGS&D Rate contract No. and the price must be mentioned. It may also please be indicated whether the supply can be made direct to us at the Rate contract price (Please note that we are not Direct Demanding Officers). If so please send copy of the RC.
5. Relevant literature pertaining to the items quoted with full specifications (and drawing, if any) should be sent along with the Quotations, wherever applicable. Samples, if called for, should be submitted free of charges, and collected back at the supplier's expenses.
6. Local Firms: Quotations should be for free delivery to this Institute. If Quotations for Ex-Godown delivery charges should be indicated separately.
7. Firms outside Madras: Quotations should be for F.O.R. Madras. If F.O.R. consignor station, freight charges by passenger train / lorry transport must be indicated. If Ex-Godown, packing, forwarding and freight charges must be indicated.
8. The rates of GST and other taxes legally leviable and intended to be claimed should be distinctly shown along with the price quoted. Where this is not done, no claim for GST/General Taxes will be admitted at any stage and on any ground whatsoever. IIT Madras is eligible for concessional GST. Relevant certificate will be issued. In case of import supply the price should be quoted without custom duty. I.I.T. Madras is exempted from levy of IGST on Imports and eligible for concessional custom duty (not exceeding 5%) and the price should be quoted on **EX-WORXS** and **CIP** basis indicating the mode of shipment.
9. Goods should be supplied carriage paid and insured.
10. Goods shall not be supplied without an official supply order.
11. Payment: Every attempt will be made to make payment within 30 days from the date of receipt of bill / acceptance of goods, whichever is later.

Yours faithfully,

[Head of the Department]

- Note: (i) Quotation should be sent by SPEED POST only or to be delivered directly to the concerned.  
(ii) Firms are requested to submit the specifications of their product along with supporting technical Documentation / brochure instead of reproducing the specifications sent by us.

**HEAD**  
Department of Civil Engineering  
Indian Institute of Technology Madras  
Chennai - 600 036.

## SPECIFICATIONS FOR AUTOMATIC TITRATOR

The specifications are divided into: (i) Equipment features, (ii) Specific technical requirements, (iii) Data analysis requirements, and (iv) Safety features.

### Equipment features

- 1) The automatic titrator should be capable of carrying out complete titration of various suspensions (mainly alkaline cementitious suspension). The analysis should comprise of Acid Neutralisation Capacity (ANC) measurement, buffer capacity measurement, and should help in acid immersion study for more than 5 days by maintaining a constant pH during the immersion period through a single unit system having automated titrant pumping. The instrument should have temperature and pH sensors integrated into single unit.
- 2) The titrator should be able to perform potentiometric (acid/base, redox, precipitation) titrations.

### Specific Technical Requirements

**NOTE:** For each specification, please enter "YES" or "NO" in the second column of this table. **If a cell in the second column is left blank, then it will be assumed that the quotation does not comply with the respective specification/requirement.** Provide catalogues, data sheets and/or other documentation to support the compliance of your equipment to the given specifications.

1 General	Yes / No	Remarks
The automatic titrator should be capable of carrying out complete titration of various suspensions (mainly alkaline cementitious suspension). The analysis should comprise of Acid Neutralisation Capacity (ANC) measurement, buffer capacity measurement, alkalinity measurement, hydroxyl value determination, quantification of ions present and should help in acid immersion study for more than 5 days by maintaining a constant pH during the immersion period through a single unit system with automated titrant pumping. The instrument should have temperature and pH sensors integrated into single unit. Single titration at a time should be sufficient.		
<b>2 pH</b>		
2.1 Range: -2.000 to 20.000		
2.2 Resolution: 0.001		
2.3 Accuracy (@25 °C): ±0.001 pH		
<b>3 Measurement of ions</b>		
3.1 Should be able to measure anion/cation like sulphate,		

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	chloride sulphur, metal ions like sodium, potassium, calcium, magnesium with max. limit of 30000 ppm		
3.2	Resolution of sulphate, chloride measurement: 0.001 ppm		
<b>4 Voltage</b>			
4.1	Measuring range: $\pm 2000$ mV		
4.2	Resolution: 0.1 mV		
4.3	Error limit (@25 °C): 0.1 mV		
<b>5 Temperature</b>			
5.1	Measuring range: -20 to 130 °C		
5.2	Resolution: 0.1 °C		
5.3	Error limit: 0.1 °C		
<b>6 Burette</b>			
6.1	Burette sizes: at least 5 nos. between 5-50 ml		
6.2	Burette resolution 1/40000 of the burette volume		
6.3	Display resolution 1 $\mu$ L		
6.4	Error limit 0.1% of the burette volume		
6.5	Fill and eject time 20 s		
6.6	Display graphic LCD		
6.7	Number of methods > 50		
6.8	Burette size should be automatically detected.		
6.9	Programmable stirrer propeller type: speed of 100-2500 rpm and resolution of 100 rpm		
6.10	Flow rate 0.1 ml/ min. to $2 \times$ burette volume/min.		
<b>7 Other specifications</b>			
7.1	Titrator should perform direct pH/ mV measurement		
7.2	Power 110 V/220 V		
7.3	Should be able to titrate at least one suspension		
7.4	Should be able to measure acid dissociation constant		
7.5	Automatic titrator should have memory to store at least 100 titration data sets with date/time stamp, transferable to printer, computer, or USB drive.		
<b>8 Manufacturer Experience, Installation &amp; Training</b>			
8.1	The manufacturer must have at least 15 years of experience.		
8.2	Provide a list of IITs or government agencies, where similar equipment were supplied and their contact details.		
8.3	Automatic titrator should be installed and commissioned by the supplier at IIT Madras, Chennai at free of cost.		
8.4	Hands-on training on the testing, data acquisition and basic maintenance of the equipment offered to be provided for a period of at least two full working days at IIT Madras, Chennai.		
8.5	The manufacturer must have well-qualified technical support team.		
8.6	Should provide comprehensive warranty for 2 years and 5		

years AMC after warranty.		
<b>9 Demo installation</b>		
9.1 Before the final purchase order is released, demonstration on acid neutralization capacity test on cement suspension provided from the lab should be done.		
9.2 Before the final purchase order is released, demonstration of 5-day concrete-acid immersion test at constant pH should be performed.		

**Data Analysis Requirements**

The software should provide the following capabilities:

- 1) Plotting of acid consumed vs. pH
- 2) Plotting of time vs. pH/acid consumed
- 3) Calculate ANC of the suspension
- 4) Should provide a tabulated form of corresponding pH, acid used, and time of acid addition to help in the manual plotting of titration curves and should be able to transfer through flashdrive or data cable.

**Safety Features**

All the safety related concerns must be stated, and details of functional access provided for safety related problems should be mentioned in detail.

*Signature*  
 17/2/2020  
**Dr. Piyush Chaunsali**  
 Assistant Professor  
 BTCM Division, Dept. of Civil Engg.,  
 IIT MADRAS, Chennai - 600 036.