INDIAN INSTITUTE OF TECHNOLOGY BOMBAY
MATERIALS MANAGEMENT DIVISION
Powai, Mumbai 400076.

PR No. 1000051620 **RFQ. No. 3000014859**

Item Description – <u>ELECTROCHEMICAL WORKSTATION (Qty – 1 No)</u>

Sr. No	Item Description	Detailed Technical Specification	Technical Compliance (Yes / No)	Additional Information (if any)
	<u>ELECTROCHEMICAL WORKSTATION</u>			
1		**<u>Electrochemical workstation with one EIS</u>**		
1. 1		i. Channels: 1 channel with EIS, should be upgradable with 1 more channel in future. ii. Electrode connection: 2, 3, 4, 5 iii. Compliance voltage: ±20 V (adjustable from ±10 V [-20; 20] V iv. Maximum output current: ±1A or better v. Current ranges: ±10 µA to ±1 A (6 ranges) with automatic current range selection vi. Accuracy of applied and measured current: < 0.1% FSR vii. Control and measured current resolution: 0.004% of the range viii. Resolution of control potential: <6 µV ix. Resolution of measured potential: <80 µV x. Control and measurement voltage accuracy: < 0.1% FSR xi. Stability control mode: adjustable bandwidths xii. EIS Frequency range from 10 µHz to 1 MHz xiii. AC amplitude: 1V (peak-to-peak) xiv. Accuracy of 1% (modulus) and 1° (phase) at 100kHz with contour plot support xv. Gain bandwidth of amplifier: 1 MHz		

		xvi.	Potentiostat risetime: < 2 µs		
		xvii.	Input impedance: ≥1 TΩ// 20 pF		
		xviii.	Input bias current: < 5 pA		
		xix.	Switching time between galvanostatic to potentiostatic modes: <3 µs		
		xx.	Acquisition time: 200 µs		
		xxi.	Cyclic voltammetry scan rates from 0.1 mV/s to 200 V/s or better		
		xxii.	5A External Booster, should be upgradable with more boosters in future.		
		xxiii.	booster chassis upgradable with more boosters in future		
		xxiv.	Possible future upgradability to high current boosters (> 700A)		
		xxv.	Should have the facility to support RRDE measurements		
1.2	**<u>System Configuration</u>**	i.	Multichannel Electrochemical Workstation in a single chassis		
		ii.	Supplied with 2 channels within the same chassis with EIS facility		
		iii.	Each channel must operate independently and simultaneously		
1.3	**<u>Measurement Capabilities</u>**	I.	Should support all voltamperometric techniques including Cyclic Voltammetry (CV), Linear Sweep Voltammetry (LSV), Open circuit potential (OCV), Chronoamperometry (CA), and Chronopotentiometry (CP)		
		II.	Electrochemical Impedance Spectroscopy (EIS)		
		III.	Pulse Techniques (DPV, SWV, NPV etc.)		
		IV.	Ohmic Drop Determination		
		V.	Electrochemical applications must include battery testing, super capacitors, electrolyzers, fuel cells, corrosion studies, electrocatalysis, and electro deposition.		
		VI.	Support for Galvanostatic Intermittent Titration Technique (GITT) and Potentiostatic Intermittent Titration Technique (PITT).		
		VII.	Columbic efficiency determination		
		VIII.	Corrosion Analysis tool like Tafel fit,		

		Polarization resistance fit IX. Basic math tools, electrochemistry fitting tools for Peak Analysis, impedance fit, Levich Analysis, Koutecký-Levich Analysis, Mott-Schottky Fit, Differential Capacity Analysis, Photovoltaic analysis, data and file processing, Capacity and energy per Cycle and sequence, Summary per protocol and cycle		
1.4	**Advanced Functionalities**	i. Real-time update of experimental parameters without pausing/stopping the experiment (Modify on the fly) ii. Specific configuration for multi electrode measurements iii. Capability to control and connect external devices iv. Global view table for monitoring all channel statuses		
1.5	**Software Requirements**	i. Pre-installed with 70+ electrochemical techniques. ii. Galvanostatic charge/discharge including C-rate control with various variable representations. iii. Multigraph and customizable variable plots for each axis. iv. At least 3 limits and 3 recording conditions per sequence or cycle (Time, Voltage, Current, Charge, Power). v. Industrial CC-CV (Constant Current – Constant Voltage) operation. vi. Current scan, voltage scan, constant power/resistance modes. vii. Tools for Columbic efficiency analysis, current interrupt, rest time, and multiple loop cycles. viii. Profile importation for Urban Life Cycle testing. ix. Analysis tools for EIS, batteries, fuel cells, corrosion, photo voltaic, super capacitors, etc.		

1.6	**Electrochemical Impedance Spectroscopy (EIS)**	i. Real-time fit and simulation with Nyquist, Bode, Admittance, Dielectric, and Mott-Schottky plots. ii. EIS measurement validation tools. iii. Drift correction for long-duration battery or corrosion studies. iv. Sensitivity functions for accurate circuit element fitting.		
1.7	**Data Acquisition & Connectivity**	i. Recording options including counter electrode potential (Ece/V), Energy (Wh), etc ii. Interfaces: Ethernet (Direct, LAN, Wi-Fi), USB iii. Local area network connectivity for multi-user access		
1.8	**Calibration and Maintenance**	I. Channels should be plug & play, easily installable and removable II. Provision of dummy cells for internal validation III. Calibration/ Validation: Software & Hardware		
1.9	**Auxiliary Inputs/Outputs**	I. 2 x analog inputs II. 1 x analog output III. 3 x TTL (trigger input/output, and safety) IV. 2 x monitor outputs (current and voltage)		
1.10	**Warranty**	1 Year Warranty after Installation.		
2		**Electrochemical workstation with two EIS**		
2.1		i. Channels: 2 nos. with EIS ii. Electrode connection: 2, 3, 4, 5 iii. Compliance voltage: ±12 V iv. Maximum output current: ±500 mA v. Current ranges: ± 1 A to 10 nA (9 ranges) with automatic current range selection (Optional accessories to measure ±1 pA in future) vi. Accuracy of applied and measured current: < ± 0.1 % of range ± 0.03 % of setting		

		vii. Control and measured current resolution: 0.004 % of the range : 760 fA viii. Resolution of control potential: <2 µV ix. Resolution of measured potential: <80 µV x. Control and measurement voltage accuracy: < ± 1 mV ± 0.03 % of setting xi. Stability control mode: adjustable bandwidths xii. EIS Frequency range from 10 µHz to 7 MHz (should be capable to upgrade in future) xiii. AC amplitude: 5V (peak-to-peak) xiv. Accuracy of 0.3% (modulus) and 0.3° (phase) at 1MHz with contour plot support xv. Gain bandwidth of amplifier: 8 MHz xvi. Potentiostat rise time: <600ns xvii. Input impedance: ≥1 TΩ// 25 pF xviii. Input bias current: <15 pA xix. Switching time between galvanostatic to potentiostatic modes: <2 µs xx. Acquisition time: 200 µs (with options to upgrade to 1µs) xxi. Cyclic voltammetry scan rates from 0.1 mV/s to 200 V/s or better (with options to upgrade to 1 MV/s) xxii. Possible future upgradability to high current internal boosters/ external boosters, xxiii. Capability to replace one of the channels with an internal booster up to 10A in future. xxiv. Should have the facility to support RRDE measurements xxv. IR Compensation xxvi. Floating Mode		
2.2	**<u>System Configuration</u>**	I. Multichannel Electrochemical Workstation in a single chassis II. Supplied with 2 channels within the same chassis with EIS facility III. Each channel must operate independently and simultaneously		

2.3	**Measurement Capabilities**	i. Should support all voltamperometric techniques including Cyclic Voltammetry (CV), Linear Sweep Voltammetry (LSV), Open circuit potential (OCV), Chronoamperometry (CA), and Chronopotentiometry (CP) ii. Electrochemical Impedance Spectroscopy (EIS) iii. Pulse Techniques (DPV, SWV, NPV etc.) iv. Ohmic Drop Determination v. Electrochemical applications must include battery testing, super capacitors, electrolyzers, fuel cells, corrosion studies, electrocatalysis, and electro deposition. vi. Support for Galvanostatic Intermittent Titration Technique (GITT) and Potentiostatic Intermittent Titration Technique (PITT). vii. Columbic efficiency determination viii. Corrosion Analysis tool like Tafel fit, Polarization resistance fit ix. Basic math tools, electrochemistry fitting tools for Peak Analysis, impedance fit, Levich Analysis, Koutecký-Levich Analysis, Mott-Schottky Fit, Differential Capacity Analysis, Photovoltaic analysis, data and file processing, Capacity and energy per Cycle and sequence, Summary per protocol and cycle		
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2.5	**Software Requirements**	I. Pre-installed with 70+ electrochemical techniques. II. Galvanostatic charge/discharge including C-rate control with various variable		

		representations. III. Multigraph and customizable variable plots for each axis. IV. At least 3 limits and 3 recording conditions per sequence or cycle (Time, Voltage, Current, Charge, Power). V. Industrial CC-CV (Constant Current – Constant Voltage) operation. VI. Current scan, voltage scan, constant power/resistance modes. VII. Tools for Columbic efficiency analysis, current interrupt, rest time, and multiple loop cycles. VIII. Profile importation for Urban Life Cycle testing. IX. Analysis tools for EIS, batteries, fuel cells, corrosion, photo voltaic, super capacitors, etc.		
2.6	**Electrochemical Impedance Spectroscopy (EIS)**	I. Real-time fit and simulation with Nyquist, Bode, Admittance, Dielectric, and Mott-Schottky plots. II. EIS measurement validation tools. III. Drift correction for long-duration battery or corrosion studies. IV. Sensitivity functions for accurate circuit element fitting.		
2.7	**Data Acquisition & Connectivity**	i. Recording options including counter electrode potential (Ece/V), Energy (Wh), etc ii. Interfaces: Ethernet (Direct, LAN, Wi-Fi), USB iii. Local area network connectivity for multi-user access		
2.8	**Calibration and Maintenance**	I. Channels should be plug & play, easily installable and removable II. Provision of dummy cells for internal validation III. Calibration/ Validation: Software & Hardware		
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2.9	**<u>Auxiliary Inputs/Outputs</u>**	I. 2 x analog inputs II. 1 x analog output III. 3 x TTL (trigger input/output, and safety) IV. 2 x monitor outputs (current and voltage)		
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