

**2021-22/02/27 Abraser Tester**

S. no.	Item	Specification
1	<b>APPLICATION</b>	<ul style="list-style-type: none"> <li>• The abrading wheels produce characteristic rub wear action. Mounted to a rotating turntable, specimens are subjected to the rub-wear action of two abrasive wheels. Driven by the test sample, the wheels produce abrasion marks that form a pattern of crossed arcs over a circular ring approximately 30 square centimeters. This reveals abrasion resistance at all angles relative to the weave or grain of the material</li> <li>• The Abraser can be used to test virtually any flat specimen. Its field of application has included tests of: painted, lacquered, powder coated, and electroplated surfaces; textile fabrics ranging from sheer silks to heavy upholstery and carpeting; and solid materials such as metals, stone and ceramics. Other materials include paper, glass, plastics, leather, rubber, linoleum, laminates, plus many others.</li> </ul>
<b><u>Technical Specification for Rotary Abraser</u></b>		
2	<b>Configuration :</b>	<ul style="list-style-type: none"> <li>• Abrader type: circular / Cyclic / Rotary model</li> </ul>
3	<b>Specification</b>	<ul style="list-style-type: none"> <li>• Should complies to ASTM D 1044</li> </ul>
4	<b>Material</b>	<ul style="list-style-type: none"> <li>• Balanced, calibrated arms and wheel mounts</li> <li>• Auxiliary Weights: 500g &amp; 1000g</li> <li>• Specimen Table: 108 mm diameter with clamp plate and nut to test rigid material.</li> <li>• Rubber pad: To ensure non slip surface during testing</li> <li>• Hold Down Ring: To clamp flexible samples</li> <li>• Refacing Discs – 100 Nos.</li> <li>• Diamond tool refacer – 01 No.</li> <li>• Specimen Mounting Card Sample Package</li> </ul>

		<ul style="list-style-type: none"> <li>• Abrading Wheels:</li> <li>• CS-10F – 05 sets</li> <li>• H-18: 05 sets</li> <li>• CS-17: 05 sets</li> <li>• Cycle Counter Display: LED / LCD display</li> <li>• Vacuum Unit with Suction Hose &amp; Round Brush</li> <li>• Platform speeds 60 and 72 rpm</li> <li>• Power supply: 115/230V, 60/50Hz</li> </ul>
5	<b>Material</b>	<ul style="list-style-type: none"> <li>• Strong structure overall steel construction</li> </ul>
6	<b>Accessories</b>	<ul style="list-style-type: none"> <li>• Calibration / Verification Kit Sample</li> <li>• Cutter</li> <li>• Wheel Refacer</li> <li>• Quiet Cabinet</li> <li>• Grit Feeder</li> <li>• Scuffing Head Attachment</li> <li>• Multi-Media Attachment</li> <li>• Interchangeable Specimen Tables</li> <li>• Extension Nut (specimen thickness ¼” to ½”)</li> <li>• Arm Height Extension Kit (specimen thickness up to 40mm)</li> <li>• Selection of Abrading Wheel Sets</li> <li>• Test Accessories</li> <li>• Haze Kit</li> </ul>
7	<b>Safety</b>	<ul style="list-style-type: none"> <li>• Overload protection circuit</li> </ul>

**2021-22/02/28 Arc Resistance Tester**

S. no.	Item	Specification
1	TYPES OF TESTS TO BE PERFORMED	To examines the specimen's ability to resist an arc with high voltage and low current exposed to the material's
2	APPLICABLE STANDARD	Should be complied to ASTM-D495 and UL 746 A
3	Test Voltage	0 – 15 kV adjustable
4		Voltage and current calibration facility should be available.
5	Input Supply Voltage	230 V ±10%.
6	Voltmeter	90-130V ±1.0 V
7	MilliAmmeter	10-40 mA ± 5%.
8	Timer	0 – 999 seconds with an accuracy of 1 second

9	Wiring	All wiring in the arc circuit must be of ignition wire rated at 15kV and higher
10	Electrodes	Stainless steel strip: 25.4 mm x 12.7 mm x 0.15 mm
11		Tungsten rod: 2.4 mm dia and 45 mm long
12	Specimen platform	Graphite
13	Specimen size	0-30 mm
14	Enclosure	Test chamber with door interlock system to protect user from direct contact of high voltage with control for user safety
15	<ul style="list-style-type: none"> <li>Dedicated PLC system for control of sequence and user friendly.</li> </ul>	
16	<ul style="list-style-type: none"> <li>Automated test controller</li> </ul>	
17	<ul style="list-style-type: none"> <li>LCD Display to set test parameters and read test results.</li> </ul>	
18	<ul style="list-style-type: none"> <li>Exhaust fans in – built in the test chamber to remove fumes</li> </ul>	
19	<ul style="list-style-type: none"> <li>Adjustable test jig to hold different test samples of various dimensions</li> </ul>	
20	Mandatory Items	<ul style="list-style-type: none"> <li>Hard copies of Operational &amp; Service Manual</li> </ul>
21		<ul style="list-style-type: none"> <li>Grinding and polishing block for electrode</li> </ul>
22		<ul style="list-style-type: none"> <li>Calibration Certificate with NIST traceability should be provided.</li> </ul>
23		<ul style="list-style-type: none"> <li>Machine should come with all other essential accessories, spares including additional one pair of electrodes required for installation, commissioning &amp; Operation.</li> </ul>
24		<ul style="list-style-type: none"> <li>Onsite training to be provided at commissioning site.</li> </ul>

**2021-22/02/29 Coefficient of Friction (Horizontal Type)**

S. no.	Item	Specification
1	Applicable standard	<ul style="list-style-type: none"> <li>Should be complied to ASTM D 1894</li> </ul>
2	Test requirement	Horizontal type
3	Weight	200 g & 500g
4	Allowable thickness	Max 1.5mm
5	Allowable Stroke	Max 150mm
6	Sliding speed	150±30 mm/min
7	Weight of table part	2.0 kg approx.
8	Measurement	Graphing software
9	Accessories	Other necessary accessories

10	Mandatory Items	<ul style="list-style-type: none"> <li>• Hard copies of Operational &amp; Service Manual</li> </ul>
11		<ul style="list-style-type: none"> <li>• Calibration Certificate traceable to NIST for required parameters.</li> </ul>
12		<ul style="list-style-type: none"> <li>• Machine should come with all other essential accessories, computer &amp; spares required for installation, commissioning &amp; Operation.</li> </ul>
13		<ul style="list-style-type: none"> <li>• Onsite training to be provided at commissioning site provided at commissioning site.</li> </ul>

### 2021-22/02/30 Coefficient of Friction (Vertical Type)

S. no.	Item	Specification
1	Applicable standard	<ul style="list-style-type: none"> <li>• Should be complied to ASTM D 1894</li> </ul>
2	Test requirement	Vertical type
3	Weight	200g (2N approx.) and 1000 g (10N approx.)
4	Allowable thickness	Max 1.5 mm
5	Allowable Stroke	Max 150 mm
6	Weight of table part	2.0 kg approx.
7	Measurement	Graphing software
8	Accessories	Other necessary accessories
9	Mandatory Items	<ul style="list-style-type: none"> <li>• Moving platform</li> </ul>
10		<ul style="list-style-type: none"> <li>• Hard copies of Operational &amp; Service Manual</li> </ul>
11		<ul style="list-style-type: none"> <li>• Calibration Certificate NIST with traceability for required parameters.</li> </ul>
12		<ul style="list-style-type: none"> <li>• Machine should come with all other essential accessories, computer &amp; spares required for installation, commissioning &amp; Operation.</li> </ul>
13		<ul style="list-style-type: none"> <li>• Onsite training to be provided at commissioning site.</li> </ul>

### 2021-22/02/31 Automatic Compression Moulding Machine

S. no.	Item	Specification
1	<b>TYPES OF TESTS TO BE PERFORMED</b>	Molding of polymeric material under compression press as per the desired size to undertake specimen preparation for various mechanical properties study.
2	<b>APPLICABLE STANDARD</b>	ASTM D4703(Method A, B, C & D) ISO 293

3		30 ton (adjustable).
4	Clamping force	<ul style="list-style-type: none"> <li>• Min300mm x min300mm polished platens for heating/cooling Capable of making compression molded plaques</li> </ul>
5	Operating mode	Manual & Automatic both
6	Max. Daylight	350 mm or equivalent
7	No. of daylight	1
8	Max. mould height	350 mm or equivalent
9	Hydraulic cylinder stroke	150 mm or better
10	Ejector force	Manual
11	Ejector stroke	Manual
12	Electrical motor	To be clearly specified by the vendor
13	Mode of operation	Operating buttons, including two-hand anti-tie down-circuit
14	Construction type	4 post/column
15		400°C or better
16	Electrical heating of platens	<ul style="list-style-type: none"> <li>• Uniform temperature distribution on platen surface.</li> </ul>
17		<ul style="list-style-type: none"> <li>• Programmable digital controller ..</li> </ul>
18	Hydraulic System	Self-contained,energy efficient hydraulic system with access panel and gauge for Oil level and temperature indication should be provided.
19		It should have dual pump system and water cooled heat exchanger.
20	Control System	<ul style="list-style-type: none"> <li>• Operating buttons, including two hand “anti-tie-down” circuit for cycle initiation.</li> </ul>
21		<ul style="list-style-type: none"> <li>• Proximately switches to control “slow close” position and “cycle reset”.</li> </ul>
22		<ul style="list-style-type: none"> <li>• Clamp pressure relief valve and gauge.</li> </ul>
23		<ul style="list-style-type: none"> <li>• Touch screen control panel</li> </ul>
24		<ul style="list-style-type: none"> <li>• PID temperature controllers.</li> </ul>
25		<ul style="list-style-type: none"> <li>• Timer up to 999 minutes.</li> </ul>
26		<ul style="list-style-type: none"> <li>• Alarm display manual / auto cycle.</li> </ul>
27		<ul style="list-style-type: none"> <li>• Emergency down and stop switches</li> </ul>

28	Cooling System	The cooling system(Water chiller of reputed make to be supplied) should be controlled by microprocessor based temperature controllers which are programmed for the specified cooling rate to maintain set temperature as per ASTM D4703(Method A, B, C & D)and ISO 293standards.
29	Safety features	<ul style="list-style-type: none"> <li>• Safety guards to be provided with the molding area with manual sliding, interlocked operator gate</li> </ul>
30		<ul style="list-style-type: none"> <li>• Automatically switching from heating to cooling mode.</li> </ul>
31		<ul style="list-style-type: none"> <li>• The system should have automatic low pressure system</li> </ul>
32		<ul style="list-style-type: none"> <li>• Thermocouples for insertion into drilled backing plates.</li> </ul>
33		<ul style="list-style-type: none"> <li>• Facility for controlling the system with Auto &amp; manual both.</li> </ul>
34	Calibration certificates	<ul style="list-style-type: none"> <li>• Calibration of platen temperature control &amp; pressure calibration to be provided.</li> </ul>
35		The machine should be supplied with suitable compression Moulds as per below specification, material feeding-manually, compression release, ejection, curing time one cycle auto.
36		Hydraulic Oil -As per requirements for Installation & operation of Machine .
37	Spares Parts	Electrical spares of reputed brand –Catridge Heaters-01 set, temperature sensor-01
38		set,solenoid valve-01 ,MCB -01no
39		While supplying the Machines, the supplier should also provide the following items apart from above:
40		<ul style="list-style-type: none"> <li>• Hard copies of Operational &amp; Service Manual- 01 Set .</li> </ul>
41	Other Mandatory Items	<ul style="list-style-type: none"> <li>• Calibration Certificate for Temperature and parallelisim for the platterns with Traceability.</li> </ul>
42		<ul style="list-style-type: none"> <li>• Hydraulic as per the requirements.</li> </ul>
43		<ul style="list-style-type: none"> <li>• Machine should come with all other essential accessories &amp; spares required for installation, commissioning&amp; Operation.</li> </ul>
<b>COMPRESSION MOULDS</b>		
44	Mould material	Stainless Steelor as mentioned in ASTM4703
45		200x200mm thickness 3.2 mm

46	Tile Mould	150mm x 150 mm each for 0.5 mm, 1.0mm, 1.5 mm, 2.0mm, and 4.0mm thickness sizes.
47	Circular mould	Male female type mould with opening tool. For preparing sheet of 120 mm diameter and 10 mm thickness as per ISO 16770
48	Specimen moulds	Cavities with specimen dimensions complying ASTM above standards to be provided
49	Mandatory Items	While supplying the Machine, the supplier should also provide the following items apart from above:
50		<ul style="list-style-type: none"> <li>• Hard copies of Operational &amp; Service Manual-01 set</li> </ul>
51		<ul style="list-style-type: none"> <li>• Basic Tool Kit box with all necessary Tools like spanner, allenkeys, scew driver set, etc ,</li> </ul>
52		<ul style="list-style-type: none"> <li>• Safety gloves &amp; goggles required for day to day activities during operation of Machine.</li> </ul>
53		<ul style="list-style-type: none"> <li>• Machine should come with all other essential accessories &amp; spares required for installation, commissioning &amp; Operation including Hydraulic Oil .</li> </ul>

**2021-22/02/32 Dielectric strength tester**

S. no.	Item	Specification
1	TYPES OF TESTS TO BE PERFORMED	To determine the dielectric
2		between a solid specimen in air and oil medium.
3	APPLICABLE STANDARD	Should be complied to ASTM D 149,
4		
5	Capacity	0-100 kV(Suitable for BDV up to 100 KV without external flashover). Mode of operation Fully automatic. Breakdown detection should perform in terms of both Voltage and Current.
6		Suitable step-up Transformer supplied from a variable sinusoidal low-voltage source with Voltage capacities range 0 to 100 kV rms

7	Voltage Source	With ratio of crest to root-mean-square (rms) test voltage, equal to
8		$\sqrt{2} \pm 5\%$ (1.34 to 1.48), with the test specimen in the circuit, at all voltages greater than 50 % of the breakdown voltage.
9	Display	Colour display with backlight. The test set should give all the test results with standard deviation, average of reading and a pass / fail message wherever necessary on LCD/LED screen, Instrument should have alphanumeric keypad to facilitate entry of test ID notes etc
10	Frequency	from 25 to 800 Hz
11	Voltage rise time & accuracy	Suitable as per Method A,B, & C of ASTM D 149 & other standard as mentioned.
12	Voltage rise time Resolution	0.1 kV $\pm 1\%$
13	Test Vessels/Medium	Air & Oil medium. Suitable Oil media Tank in line with the requirement of Standard
14	Test Temperature range	Ambient to 100°C. Suitable heaters should be provided for heating oil bath. Test kit should have automatic oil temperature measurement facility with a temperature sensor resolution of 1°C or better.
15	Temperature resolution	1 °C or better
16	Power supply	voltage - 85 to 265 VAC
17		frequency - 50/60 Hz
18	Interface	RS-232 interface , I/O port with safety interlock, USB Host Port for Data/Program storage
19	Protection provided to equipment	Dual safety micro switches on chamber cover. HV Chamber
20	Mandatory Items With the Machine	AC/DC Digital Voltage Meter: 50,100,150,200kV
21		DC micro-ammeter
22		Electrode set of Type 1 to Type 7 as per standard
23		<ul style="list-style-type: none"> <li>• Vendors must have sufficient experience in supplying equipment to reputed organizations of Plastic/polymer Industries</li> </ul>
24	Additional Requirements - Special Features Needed	<ul style="list-style-type: none"> <li>• Magnetic bead stirrers</li> </ul>
25		<ul style="list-style-type: none"> <li>• Sample cutter as per standard.</li> </ul>



26		<ul style="list-style-type: none"> <li>• A suitable Voltage calibrator meter should be provided along with equipment which should be oil free</li> </ul>
27	Other Mandatory Items	While supplying the Machines, the supplier should also provide the following items apart from above:
28		<ul style="list-style-type: none"> <li>• Hard copies of Operational &amp; Service Manual-01Set.</li> </ul>
29		<ul style="list-style-type: none"> <li>• Traceable Calibration certificate of equipment.</li> </ul>
30		<ul style="list-style-type: none"> <li>• Machine should come with all other essential accessories,</li> </ul>
31		<ul style="list-style-type: none"> <li>• Commissioning &amp; Operation.</li> </ul>

**2021-22/02/33 Electrodynamic Shaker**

S. no.	Item	Specification
1	<b>Scope of supply</b>	<ul style="list-style-type: none"> <li>• Electrodynamic vibration shaker with base table</li> </ul>
2		<ul style="list-style-type: none"> <li>• Power amplifier</li> </ul>
3		<ul style="list-style-type: none"> <li>• Shaker cooling systems and other auxiliaries</li> </ul>
4	<b>General Specifications for shaker</b>	<ul style="list-style-type: none"> <li>• Acceleration:</li> </ul>
5		✓ Bare table - 110 g pk
6		✓ 1 lb load - 55 g pk
7		✓ 5 lb load - 18 g pk
8		<ul style="list-style-type: none"> <li>• Stroke size: 1 Inch</li> </ul>
9		<ul style="list-style-type: none"> <li>• Velocity (Max.): 70 ips pk</li> </ul>
10		<ul style="list-style-type: none"> <li>• Sine Force: 110 lbs force pk</li> </ul>
11		<ul style="list-style-type: none"> <li>• Random Force: 75 lbf rms random</li> </ul>
12		<ul style="list-style-type: none"> <li>• Shock Force: 225 lbf pk</li> </ul>
13		<ul style="list-style-type: none"> <li>• shock Frequency Range: DC to 6,500 Hz</li> </ul>
14		<ul style="list-style-type: none"> <li>• Max. Acceleration: 110 g pk,</li> </ul>
15		<ul style="list-style-type: none"> <li>• Maximum acceleration</li> </ul>
16		✓ Resonant 150 g pk
17		✓ Peak shock 200 g pk
18		<ul style="list-style-type: none"> <li>• Max. Displacement:</li> </ul>
19		✓ Continuous pk-pk - 1.0 inch
20		✓ Between stops - 1.03 in
21		<ul style="list-style-type: none"> <li>• Cooling: Amplifier: forced air</li> </ul>
22		<ul style="list-style-type: none"> <li>• Shaker: cooling blower</li> </ul>
23		<ul style="list-style-type: none"> <li>• Output voltage: 50 V rms</li> </ul>
24		<ul style="list-style-type: none"> <li>• Output current: 20 A rms</li> </ul>
25		<ul style="list-style-type: none"> <li>• Max. cont. dissipation 900 W</li> </ul>
26		<ul style="list-style-type: none"> <li>• Frequency response</li> </ul>
27	✓ DC input: DC to 10 KHz -.6 dB	
28	✓ AC input: 1.0 to 10 KHz -.6 dB	
29	<ul style="list-style-type: none"> <li>• Max. voltage gain: 36 dB</li> </ul>	
30	<ul style="list-style-type: none"> <li>• Cooling 2-speed fan, automatic</li> </ul>	
31	<ul style="list-style-type: none"> <li>• Input impedance: 10 kΩ</li> </ul>	

32	<b>General Specifications for Linear Power Amplifier:</b>	✓ Volts, pk 19 segment $\pm 5\%$	
33		✓ Amps, rms 19 segment $\pm 5\%$	
34		• Interlock circuit External: F.O. switch or TTL Shaker	
35		• Optional field power: 1000 W max	
36		• Interlock protection:	
37		• Over current	
38		✓ Supply over voltage	
39		✓ Power module failure	
40		✓ Amplifier cooling	
41		✓ Vibrator cooling	
42		✓ Power module over current	
43		✓ Phase failure	
44		<b>Specification for Vacuum Cooling system</b>	• Blower type:
45	• Flow @ pressure:		30 cfm @ 30" H <sub>2</sub> O min
46	• Motor:		0.75 Hp
47	• Intake:		0.63" & 0.75" dia. (shaker fittings included)
48	• Hose length:		7.5', flexible vacuum
49	• Minimum vacuum life		>25,000 Hrs
50	• Noise Level:		< 71 dB @ 1M
51	<b>Power</b>	• 230V AC $\pm 10\%$ , Single phase and 50 Hz.	

**2021-22/02/34 Electrometer**

S. no.	Item	Specification
1	Purpose	Current, Voltage, Resistance, Impedance and Charge measurement
2	Function	Current, Voltage, Resistance and Charge measurement
3	Voltage range	2 $\mu$ V-200 V or better
4	Current range	2fA-20 mA or better
5	Resistance range	100 $\Omega$ - 200 G $\Omega$
6	Noise level	< 1 fA or better
7	Impedance for Voltage measurement	200 T $\Omega$ or more
8	Charge measurement range	10 fC to 2 $\mu$ C or better
9	Data reading speed	High speed - up to 1200 readings/second or better
10	DMM Connectivity	GPIB, RS232, USB
11	Digit resolution	5.5 or better
12	Cables & USB connector	• Low Noise Cable with Alligator Clips (3-Slot)
13		• NI - USB-to-GPIB Interface Adapter
14	Safety	<b>Overflow indication</b>

15	Operational Condition	Operating: 0°–50°C; relative humidity: 50 - 70% non-condensing, up to 35°C. Storage: –25° to +65°C
16	Voltage	AC 220V Single Phase, 50/60 Hz
17	Software	Necessary software for measuring I-V, I-t, V-t, etc., through computer
18	Features	<ul style="list-style-type: none"> <li>• Interfaces readily with switches, computers, and component handlers</li> <li>• Cancels voltage and current offsets easily.</li> </ul>
19		<ul style="list-style-type: none"> <li>• Current sensitivity, coupled with low-voltage burden.</li> </ul>
20		<ul style="list-style-type: none"> <li>• Photodiode dark-current measurements.</li> </ul>

### 2021-22/02/35 Fusion Deposition Modelling System

S. no.	Item	Specification
<b>1</b>	<b>MACHINE</b>	
1.1	Technology	Solid based additive manufacturing system (Latest Fused Deposition Modelling system)
1.4	Build Volume	Minimum build volume 190 * 190 * 190 mm
1.5	Nozzles	<p>2 (Dual Wear Resistance Nozzles). Must be capable of having e.g., water soluble for one nozzle for support creation and having another material e.g., ABS on another nozzle for part creation.</p> <p>Nozzles: 0.05, 0.1, 0.25, 0.4, 0.6, 0.8 mm</p>
1.6	Layer resolution	Minimum 20 micron or better
1.7	Part accuracy	Parts produced should be within an accuracy of +/- 0.2 mm
1.8	Support structure	Soluble and breakaway
1.9	Machine Control	<p>Machine should build parts in circulated air heated chamber two or more heat exchangers and blowers to provide uniform temperature control and heated build environment throughout the volume of the build and each layer of the print.</p> <p>Chamber Temperature: 100°C or higher.</p> <p>Non Heated removable and flexible build plate made from heat absorbing material such as Polycarbonate or equivalent</p> <p>Motion controlled components should place outside and should be insulated from the heated build chamber.</p>

		<p>The support material distinct material which should extrude from a different printhead/nozzle.</p> <p>The machine shall automatically calibrate nozzle and build platform in X, Y and Z axis before the start of each job.</p>
1.1	Material Flow Rate	500 mm <sup>3</sup> /sec or better
1.11	Extruder/ Nozzle Temperature	300 °C or Better
1.12	Monitoring	Live camera for tracking and monitoring, Mobile app for android and iOS should be available.
1.13	Material Handling	<p>Material handling systems should be part of the Printer with automatic material loading, feeding and storage management system. Material cabinet should be dry sealed with humidity control. All material spool/cartridges (model and support) should have an EEPROM/chip to indicate the quantity of material available in the spool / cartridge at any instance of the machine operation during idle or run time.</p> <p>For large jobs. The machine shall automatically pause and prompt the operator to replenish material and resume printing in case of the material (for both model and support) gets consumed during the build process. The machine should keep the chamber temperature and heated airflow constant while the machine is paused.</p>
1.14	Connectivity	Wi-Fi, USB, LAN/SD card compatible
1.15		Touch Screen
1.16	User Interface	Using computer with appropriate software. Software should display and control. Complete program of solution must be provided.
1.17	Slicing software	<p>Software should be able to import any native CAD formats like stl, obj igs, vrm. stp, Parasolid, native files of CAD packages etc and be able to repair errors like open surfaces, inverted normal etc without use of any 3rd party software.</p> <p>Software should be from same OEM; 3<sup>rd</sup> party software is not allowed. License must be perpetual and cloud support must be available.</p>
<b>2</b>	<b>Materials</b>	

2.1	Materials	<p><b>Standard Materials (Print Settings should be pre-configured in machine and software):</b> ABS, ASA, Chemical Resistant Material, Nylon12, Carbon Fiber re-enforced material, PC-ABS, Fire-Resistant PC-ABS</p>
		<p>Research Material: User should be able to run self-developed/open-source materials metal and polymer filaments.</p>
		<p>Vendor should quote all possible materials and supply 5 Nos. of Canister on each material, excluding the quantity of material required for installation, training, and calibration. Machine should be calibrated to fabricate parts with all the materials mentioned above at the time of installation.</p>
		<p>Machine should have the provision of testing materials developed by the customer and professional guidance should be given to adhere to the system compatibility and configuration</p>
		<p>Vendor should attach the quality certificate of each material with test report evaluating the parameters according to ASTM/DIN standards tested on same/similar machine from same OEM.</p>
2.2	Customised material guidance	<p>Machine should have the provision of testing materials developed by the customer and professional guidance should be given to adhere to the system compatibility and configuration</p>
2.3	Material Quality	<p>Vendor should also supply proven parameters for all the suitable materials with clear documentation and statistics of the mechanical properties with respect to build orientation and layer thickness.</p>
2.4	Material Property	<p>Vendor should also supply proven parameters for all the suitable materials with clear documentation and statistics of the mechanical properties with respect to build orientation and layer thickness.</p>
<b>3</b>	<b>ESSENTIAL ACCESSORIES</b>	
3.1	Support removing system	<p>As per the requirement to be quoted by the bidder</p>
3.2	Consumables	<p>Vendor should supply minimum quantities of consumables like build platforms, nozzle for all layer thickness, wiper blade, brush etc., required for 6 months</p>

3.3	Tool kit	Vendor should supply standard tool kit for start-up, removal of parts and cleaning (list to be attached).
3.4	Any other accessories required	Vendor should supply all the other accessories, material transport trolleys / carts and spares required for effective and better utilization of machine. All the required accessories should be listed
3.5	Compressor	Vendor should supply Suitable compressor with dryer and all necessary accessories
3.6	De-humidifier	Vendor should supply suitable de-humidifier to maintain room humidity level within suitable range for machine operation.
3.7	Online UPS	Vendor should supply suitable UPS with minimum 60 minutes power backup for the machine and essential accessories. Should have built in safety to protect machine from voltage spikes and sudden surges.
3.8	Workstation with accessories	Vendor should supply suitable OEM workstation computer system with complete accessories and UPS. It should have minimum of i7 (3.4 GHz, quad core) processor of latest configuration, 64GB RAM (2400MHz, DDR4), 1TB hard disk (7200 RPM), and 4GB graphics card or better configuration, with windows operating system and MS office recent version.
<b>4</b>	<b>OTHER ESSENTIAL REQUIREMENTS</b>	
4.1	Benchmark part	Vendor should submit two numbers of benchmark parts in two material which should be built in the quoted machine same is to be built during prove out of the machine at the site
4.2	Manufacturer's/Suppliers Credential Credentials	Supplier should have sizable installations of same model worldwide and at least three same or similar models in India. Supplier should submit complete contact details and acceptance letter from the recent customers.  Manufacturer of the quoted equipment should be ISO certified and should have supplied same/similar machine in India/globally for a period of minimum of 10 years.

4.3	Safety Requirements	The machine and all the accessories supplied to meet objective should be able to operate without any risk or hazard, without any additional protection, provision, training or guarding devices and meet current international standards such as CE, FCC, EMC, Low Voltage Directive 60950-1, 62368 - Certificate of Conformance to be attached
4.4	Scope of supply	Vendor should supply complete start up package necessary to prove the machine and provide training. List for scope of supply to be submitted.
4.5	Environment Protection	The machine and all the accessories supplied should be safe to use without emission of any hazardous gases, noise level and radiation without any need for additional equipment, provision or training and meet current international standards
4.5	Consumables & accessories and their availability	List all such material that will be used in building part. Tender shall include list of all essential spares and consumables to be provided with replacement time prescribed for each such item and its availability within reasonable time period. In case if any such item is likely to be out of availability within service period of machine, such item shall be included in initial supply
4.6	Price list of material, spares, and consumables	Price list of each material with minimum order quantity, machine spares and consumables are to be quoted.
<b>5</b>	<b>INSTALLATION, COMMISSIONING AND TRAINING</b>	
5.1	Installation and requirements	Vendor should state the space required and condition of floor and any other requirements for installation of the machine and equipment's. State clearly the specifications of the following items required for installation such as Transformer, chiller, UPS, Air conditioner, Dehumidifier, separate special earthing, vibration isolation
5.2	Training and documentation	Minimum of 5 days training for five persons which includes basic & advanced level training. Training content and plan to be submitted. Training faculty must have adequate experience in this field.
		The vendor should supply the necessary manuals such as
		<input type="checkbox"/> Software instruction <input type="checkbox"/> Maintenance and trouble manual

J.2		<input type="checkbox"/> Training <input type="checkbox"/> Installation and Commissioning <input type="checkbox"/> Handling of accessories <input type="checkbox"/> Software key (if any) <input type="checkbox"/> Software CDs
	Installation and requirements commissioning	The vendor should support necessary site preparation for installation. Vendor should carry out installation and commissioning of the machine and its accessories on a turnkey basis

**2021-22/02/36 Gloss meter**

S. no.	Item	Specification
1	Purpose	Measurement of Specular Gloss of plastic films & sheets
2	Reference Standard	Should be complied to ASTM D2457, ASTM D523, ISO 2813, ISO 7668, DIN 67530, JIS 8741
3	Projecting angle	20, 45, 60 & 85 degree Angles
4		Triple geometry display
5	Light Source	Incandescent Lamp
6	Measuring Area	20 degree: 10 mm X 10 mm
7		45 degree: 9mm X 13 mm
8		60 degree: 9mm X 13 mm
9		85 degree: 5 mm X 38 mm
10	Range	0 – 1500 GU (Gloss Unit) or higher
11	Repeatability	±0.2 GU or better
12	Reproducibility	± 0.5GU or better
13	Measuring time	0.5 Seconds/geometry or better
14	Power Supply	230 V & 50 HZ (With the battery model)
15	Calibration	Automatic by means of built – in Microprocessors
16	Standard Reference	One standard tile for 20 deg., 45 deg., 60 deg., and 85 deg., with certificate should be provided
17	Operating Temperature range	Up to 40°C
18	Memory	999 Measurement values with the date and time.
19	Digital Display	Alphanumeric LCD
20	Data transfer	Bluetooth, PC compatible, USB connection
21		While supplying the Machines, the supplier should also provide the following items apart from above:
22		<ul style="list-style-type: none"> <li>• Hard copies of Operational &amp; Service Manual- 01 Set..</li> </ul>



23	Other Mandatory Items	<ul style="list-style-type: none"> <li>Machine should come with all other essential accessories, computer &amp; spares required for installation, commissioning &amp; Operation</li> </ul>
24		<ul style="list-style-type: none"> <li>Onsite Training to be provided for CIPET staff at commissioning site.</li> </ul>
25		<ul style="list-style-type: none"> <li>Calibration certificate with NIST traceability</li> </ul>

**2021-22/02/37 Glove box**

S. no.	Item	Specification
1	Purpose	✓ Storage of air sensitive chemicals and fabricated devices.
2		✓ Fabrication of high end electronics, energy storage and energy conversion devices
3	Glove box	Glove box
4	Moisture level Requirements	< 1.0ppm
5	Oxygen Level Requirement	<1.0 ppm
6	Environment	Nitrogen and Argon
7	Material of construction	Stainless Steel of high quality (grade to be mentioned by bidder)
8	Box Windows	Transparent Polycarbonate which can retain pressure range of -15 mbar to +15 mbar
9	Pressure	✓ Automatic Pressure control from -15 mbar to + 15mbar
10		✓ Continuous Digital Pressure monitoring of the glove box
11	Display of Reading	High accuracy sensor based reading of moisture and oxygen level in ppm levels to be displayed at all-time along with Glove box pressure, purging condition, regeneration etc. which should be monitored/controlled through a microprocessor based control system.
12	Box	<ul style="list-style-type: none"> <li>Scratch proof coating to protect the inner and outer housing</li> </ul>
13		<ul style="list-style-type: none"> <li>Dust filter of 0.3 micron</li> </ul>
14		<ul style="list-style-type: none"> <li>Gas inlet and outlet filter.</li> </ul>
15		<ul style="list-style-type: none"> <li>3 height adjustable shelves</li> </ul>
16		<ul style="list-style-type: none"> <li>3 Electrical feed through</li> </ul>
17		<ul style="list-style-type: none"> <li>Stand for the box along with levelling</li> </ul>

18		<ul style="list-style-type: none"> <li>• Foot pedal control of the internal pressure</li> </ul>
19		<ul style="list-style-type: none"> <li>• Waterproof</li> </ul>
20	Antechamber Large	<ul style="list-style-type: none"> <li>• One antechambers made up of stainless steel with metal doors which can be interlocked to maintain pressure range of -10 mbar to 10 mbar.</li> </ul>
21		<ul style="list-style-type: none"> <li>• Pressure gauges to monitor the pressure.</li> </ul>
22		<ul style="list-style-type: none"> <li>• Metal Sliding tray to transport sample</li> </ul>
23		<ul style="list-style-type: none"> <li>• Manual Control of Vacuum and Refill process</li> </ul>
24		<ul style="list-style-type: none"> <li>• Door lock easy to operate with a spindle lock system</li> </ul>
25		<ul style="list-style-type: none"> <li>• One large antechamber for transporting larger volume inside the glove box. At least 390 mm diameter, 600 mm length</li> </ul>
26	Antechamber Small	<ul style="list-style-type: none"> <li>• Small Antechamber to allow transfer of Min. 100 mm Petridis diameter.</li> </ul>
27		<ul style="list-style-type: none"> <li>• 3 way valve control with analog pressure gauge.</li> </ul>
28	Gas purification	<ul style="list-style-type: none"> <li>• Closed loop gas purification with attainable moisture and oxygen level of &lt; 0.1 ppm over complete pressure range for the complete volume of gas.</li> </ul>
29		<ul style="list-style-type: none"> <li>• Accessories and columns required for the gas purification should be provided by bidder.</li> </ul>
30	Circulation Unit	Suitable blower with adequate capacity should be provided with the unit for adequate circulation along with other accessories.
31	Regeneration	Automatic regeneration control and electronic control of inlet and outlet of regeneration gas.
32	Vacuum Pump	Rotary Oil Pump of industrial required which will be capable of running 24 hours. The pump should have an oil mist filter and control for gas ballast.
33	Control System	Rotary vane mechanical vacuum pump with necessary moisture and vapour traps details should be provided

34	Running Time	The instrument and the ancillary vacuum pumps should be capable for running 24 hours
35	Box Dimensions and number of ports	✓ Suitable dimension to allow minimum 02 pair of gloves (neoprene rubber) in front to be used for accessing the box.
36		✓ Typical dimension of each glove port would be 200mm-220 mm diameter
37	Chemical Storage Requirements	The glove box and its parts should be compatible for storage and usage of
38		• Organic solvents both chlorinated and unchlorinated.
39		• Use of electrolytes and ionic liquids
40		• Intermittent usage of acids and bases
41	Box Light	1 or 2 tube light front mounted with adequate illumination.
42	Valves and Piping	• Pneumatic Valve to control pressure in case of gas shut down for at least 12 hours.
43		• Stainless Steel Piping
44	Oxygen Analyzer	Microprocessor controlled analyzer to monitor from 1 – 1000 ppm
45		• Operating Temperature: ambient to 35°C
46		• Pressure - 800 - 1200 hPa
47		• Sensitivity - 10 mV/ppm(v)
48		• Response time- < 10 sec
49		• Accuracy: +/- (2 % of displayed value + 1 ppm)
50		• Zero Stability: <1ppm/24 h
51		• Repeatability: +/- 1% in full range
52		• Resolution: +/- 0.1% in full range
53		• Probe/ analyzer type to be provided
54		• In-house calibration procedures to be provided
55	Moisture Analyzer	Microprocessor controlled analyzer to monitor from 1 – 500 ppm
56		Accuracy: +/- 2 °C DP
57		Probe/ analyzer type to be provided
58	Filters	Charcoal Filter or better system for moisture removal to achieve the required level of moisture as specified.

59	Catalyst for Oxygen	Suitable technology for oxygen removal to achieve the required level as specified
60	Energy Conservation	Any energy conservation technology would be preferred
61	Others	<ul style="list-style-type: none"> <li>Piping and fittings Should be made of stainless steel</li> </ul>
62		<ul style="list-style-type: none"> <li>Electrical · Lighting: Internal LED/fluorescent lamp and provision of electrical points inside the chamber with leak proof sealing</li> </ul>
63		<ul style="list-style-type: none"> <li>Operating voltage: 230 V (<math>\pm 10\%</math>), 50 Hz</li> </ul>
64		<ul style="list-style-type: none"> <li>Additional 03 pair of gloves and O rings</li> </ul>
65	Accessories	<ul style="list-style-type: none"> <li>Rotary oil</li> </ul>
66		<ul style="list-style-type: none"> <li>Nitrogen and argon cylinder with regulator</li> </ul>
67		<ul style="list-style-type: none"> <li>Required additional accessories should be provided.</li> </ul>

**2021-22/02/38 Impedance Analyzer**

S. no.	Item	Specification
1	Purpose	Measurement of the dielectric, ferroelectric, piezoelectric properties of the materials. Measurement of impedance in the range between 100m $\Omega$ to 2G $\Omega$ or better with a broad frequency range.
2	Measurement frequency	20 Hz to 50MHz upgradable
3	Frequency resolution	1mHz or better
4	Basic Accuracy	$\pm 0.05\%$ or better
5	Measurement parameters	Capacitance (C), Inductance (L), Resistance (R), Reactance (X), Conductance (G), Susceptance (B), Dissipation Factor (D), Quality Factor (Q), Impedance (Z), Admittance (Y), Phase Angle ( $\emptyset$ ), Permittivity, Permeability, Polar & complex plots and additional measurements parameters are preferable.
6	Measurement modes	LCR mode, Analyzer mode, Continuous measurement mode, Equivalent circuit analysis functions
7	Measurement circuit	Series/Parallel
8	Correction	Open Circuit/ Short Circuit/Load Correction

9	Test signal	Rms Voltage: 10 mV to 1V or better
		Voltage resolution: 1 mV or better
		Current: 200µA - 20mA
		Current Resolution: 20 µA or better
10	No. of Measurement Points	Upto 1600 or better in one sweep analysis.
11	Ranging	Auto /Manual (both)
12	Sweep Parameters	Frequency, signal voltage, signal current, DC bias voltage, DC bias current
13	Sweep type	Linear frequency, log frequency, OSC level, DC bias
14	Display	Touch screen, Instrument should be able connect Monitor for display.
15	Interfaces	GPIB , LAN, USB, RS232 should be available
16	Marker search	Maximum value, minimum value, multi-peak, multi-target, peak, peak left, peak right, target, target left, target right, and width parameters with user defined bandwidth values
17	Test fixtures	1. Materials test fixture
		2. Liquids fixture with BNC converter
		3. SMD test fixture compatible upto 120 MHz
		4. Bottom Electrode SMD Test Fixture
		5. Axial & radial test fixture
		6. SMD Tweezers test fixture upto 120Mhz
		7. Kelvin Clip-type test fixture
18	High temperature option with variable temperature	○ High temperature accessories (RT-500 °C)
		○ High temperature holder for bulk samples
		○ PID temperature controller
		○ Data logging software: Parameter Vs Frequency, Parameter Vs Temperature
		○ Interfaced: RS232
		○ Interfacing Cables: BNC coaxial cables should be provided along with the setup
19	Accessories	○ Supplier should add the required accessories
20	Connectors	● Require 4 (four) BNC cable to BNC cable connection
		● Converter 4 to 1 and 2
21	Power supply	220 to 240 V AC, 50/60 Hz

22	Operation Environment	Temperature: 10 ~ 40 or higher Humidity: 90%
23	Manual Accessories	Power cord , Instruction manual , PC communication instruction manual (CD-R)
24	Personal Computer (PC)	A Personal Computer (PC) having latest configuration with complete accessories and UPS. It should have minimum of i7 (3.4 GHz, quad core) processor of latest configuration, 1TB hard disk or better configurations. All softwares shall be loaded in the hard disk with appropriate partitions. All original CDs/DVDs must be provided. The scope of supply also includes a good (reputed make, please give the details) Colour Laserjet Printer having a resolution of 1200 × 1200 dpi or better.
25	Software	Suitable software for PC Equivalent circuit analysis with licence
26	Calibration	<ul style="list-style-type: none"> <li>• Provide trimming standards for calibration</li> <li>• The Impedance Analyzer should be pre-calibrated</li> <li>• The OEM provide calibration certificate.</li> </ul>
27	Compatibility	Instrument should be compatible with high Temperature and Low temperature systems

**2021-22/02/39 Hot Air Oven**

S. no.	Item	Specification
1	Application	To dry samples, glassware's and synthesis of nanomaterials
2	Temperature Range	5°C above ambient to 300°C maximum or better
3	Temperature Accuracy	+ / -0. 5°C or better
4	Temperature Uniformity	+ / - 1°C
5	Controls	Digital PID Control by Advanced Microprocessor
6	Temperature Display	Digital LED / LCD
7	Sensor	PT-100
8	Timer	Digital Pre-Set Timer 999 Hrs

9	Volume	90L or Better
10	Heating Element	Nichrome wire / Kanthal A1 or better
11	Safety device	Over temperature protection
12		Electric leakage breaker
13		Temperature safety as per DIN 12880 Class 3.1
14	Exterior Chamber	MS powder coated
15	Interior Chamber	304 or 316 stainless steel
16	Insulation	Glass wool insulation between the walls
17	Doors	Solid doors with silicone rubber gasket & lock
18	Shelves	2or 3 Stainless steel shelves (Removable)
19	Air Circulation	Forced air circulation
20	Features	• Glass window in-built into the door for easy viewing of samples.
21		• Automatic cut off of heater & blower when door opened.
22		• Digital PID temperature controller with timer, alarms and auto tuning.
23		• Forced Air Circulation system to maintain uniform temperature in the chamber.
24		• Polished stainless-steel chamber, Semi-circular arcs at corners for easy cleaning, and the space between the shelves in the chamber is adjustable.
25	• Independent audible and visible temperature limiting alarm system ensures experiments run safely.	
26	Installation & Training:	Installation and Training to be provided at installation site. Installation requirement to be submitted in advance to provide suitable power connection and suitable working space for the instrument. All parts/accessories required for meeting the pre-installation as well as operation of the instrument should be quoted by the supplier.
27	Calibration	Calibration certificate traceable to NIST for Temperature controller is essential.
28	Manuals:	One set of manuals with all details of parts should be supplied

29	Warranty:	Comprehensive 2-year warranty covering all spare parts and labour.
30	Available Input power:	220 V one phase/three Phase, 50 Hz

### 2021-22/02/40 Lab-Scale Twin Screw Extruder for 3D printing filament

S. no.	Item	Specification
1	Extruder type	Parallel, Co-Rotating, Lab scale Twin Screw Extruder. Filament measuring and controlled unit with closed loop for precise adjustment of the 3D filament diameter.
2	Application	Extrusion of polymer monofilament for 3D printing.
3	Barrel	<ul style="list-style-type: none"> <li>• L/D ratio: 40:1 or as suitable for manufacture and recipe development of thermoplastic and engineering polymers.</li> <li>• The system must have an atmospheric vent facility with proper adaptor.</li> </ul>
4	Screw Diameter	<ul style="list-style-type: none"> <li>• Minimum 11 mm</li> </ul>
5	Screw speed	10 to 1000 rpm
6	Torque per shaft	Minimum 6 Nm, constant torque with safety monitor
7	Ratio screw outer dia./ inner dia.	1.72 or more to allow feeding of fluffy materials
8	Pressure	100 bar or Higher with safety monitor
9	Temperature	Room temperature to 450°C
10	Feed zone	Permanently water cooled with refrigerated chiller to be included
11	Heating zones	With minimum of 5 zones with electrical heated (optional water cooling should be quoted)
12	Extruder control	<p>Extruder control is via an integral colour touch screen for monitoring of following parameters:</p> <ul style="list-style-type: none"> <li>• Extruder speed (rpm)</li> <li>• Extruder torque (%)</li> <li>• Barrel temperatures (Deg. C)</li> <li>• Pressure (bar)</li> <li>• Volumetric/Gravimetric feeder speed (%)</li> <li>• Able to monitor the filament dia.</li> </ul>



13	Feeding systems	<p>Minimum 2 nos. feeding zone - One for polymer and other for powders/fillers/Additives with the following requirement:</p> <p>Volumetric/Gravimetric Single Screw Feeders for polymer with feed funnel and hopper (minimum volume of 1.3 litres or more).</p> <p>Safety grid feeder which controls by main control panel with safety interlocked feeder support.</p> <ul style="list-style-type: none"> <li>• Feeder for base polymer: Single screw feeder to feed powder or pellets into the main feeding or a secondary feeding port.</li> <li>• Feeder for feeding powders: Twin Lead Feeder screw with core for minimal output. Suitable for powder materials.</li> </ul>
14	The extruder should be supplied with 3D strand die	<p>Strand diameter can be easily altered using various set of die inserts (0.5, 1, 1.5, 1.75, 2, 2.5, 3 mm).</p> <p>Allows quick change of the die diameter. Should contains a set of threaded die nozzle (0.5, 1, 1.5, 1.75, 2, 2.5, 3 mm).</p>
15	Melt pump	<p>The extruder must be supplied with a melt pump to eliminate the pulsation in the polymer melt flow. The melt pump should be fully compatible with the extruder with the flowing specifications:</p> <ul style="list-style-type: none"> <li>• Pump head volume: 0.6 cm<sup>3</sup>/rev or better</li> <li>• Pump speed: 0.1 to 50 rpm or more</li> <li>• Heating zones: 1 (1 internal / 1 external)</li> <li>• Temperature: Room temperature to 450 °C</li> <li>• Pressure: 500 bar or better</li> </ul>
		<p>The extruder should be supplied with post extrusion accessories like water bath, spooler and laser diameter measuring system to take up, measure and wind up the strand for 3 D printing.</p> <p>The spooler must be compatible with extruder die height and must have the following specifications:</p>

16		<ul style="list-style-type: none"> <li>• Adjustable line speed with self-adjusting compensation for spool diameter.</li> <li>• Filament distribution traverse with settable travel to compensate spool width.</li> <li>• Line speed: 0.5 -15 m/min or more</li> <li>• Filament diameter: 0.5 - 3 mm</li> <li>• Mas spool width: 100mm or better</li> </ul> <p>Laser diameter measuring system:</p> <ul style="list-style-type: none"> <li>• Measurement range: 0.1-5mm or better</li> <li>• Measurement accuracy: <math>\pm 0.002</math>mm or better</li> <li>• Resolution: 0.001mm</li> <li>• Should be capable of identifying the variation of diameter while extruding for maintaining the desired diameter</li> <li>• Fully automatic closed loop control technology for precise control of filament diameter.</li> </ul>
17	Vacuum system	Compatible vacuum system to be attached with extruder
18	Chiller	Refrigerated circulator chiller to cool and maintain the extruder zones temperature
19	Other accessories as a part of supply	<ul style="list-style-type: none"> <li>• Extra Screw element set: To change the screw profile and should contain the following: <ul style="list-style-type: none"> <li>4 x Feed Screw, 1 L/D</li> <li>2 x Feed Screw, 0.5 L/D</li> <li>2 x Reverse Feed Screw, 0.5 L/D</li> <li>8 x Mixing Element 0°, 0.25 L/D</li> <li>8 x Mixing Element 90°, 0.25 L/D</li> </ul> </li> <li>• Anti-Seize paste</li> <li>• High Volume Feed Screws: A set of asymmetrical shaped geometry feed screws to increase free volume and to allow feeding commercial pellet sizes (=4 mm) into the extruder.</li> </ul>
20	Essential spares/ Accessories	<ul style="list-style-type: none"> <li>Tool box</li> <li>Purging kit</li> <li>Compressor as per the requirement</li> <li>Spare should be available for smooth running of instrument for minimum of 02years.</li> </ul>

21	Software	Compatible to Windows 10 or higher
		Required system controlled through using appropriate software and interphases for quick and reliable data acquisition and analysis.
		Upgradable software for complete data analysis/programming.
22	Personal Computer (PC)	A Personal Computer (PC) i7 10 <sup>th</sup> Generation latest Processor 2tb HDD, 21" LCD monitor 8Gb RAM. OEM Windows 10 Professional. All software shall be loaded in the hard disk with appropriate partitions. All original Software DVDs must be provided. The scope of supply also includes a good (reputed make, please give the details) Colour Laserjet Printer having a resolution of 1200 × 1200 dpi or better.
23	Other Mandatory Items	While supplying the Machines, the supplier should also provide the following items apart from above:
		<ul style="list-style-type: none"> <li>• Hard copies of Operational &amp; Service Manual- 01 Set.</li> <li>• Machine should come with all other essential accessories &amp; spares required for installation, commissioning &amp; Operation.</li> <li>• Onsite Training to be provided for CIPET official at the commissioning site.</li> </ul>
24	Warranty	3 years comprehensive warranty should be provided
25	Maintenance	The system should come with an initial annual maintenance cover (AMC) of minimum 03 years after completion of warranty period.

**2021-22/02/41 Multi-channel Electrochemical Workstation**

S. no.	Item	Specification
1	<b>APPLICATION</b>	<ul style="list-style-type: none"> <li>• Battery, Super capacitor, Corrosion, Electrodeposition, Electro catalysis</li> </ul>
2		<ul style="list-style-type: none"> <li>• Electrochemical Impedance Spectroscopy Studies (EIS)</li> </ul>
3		<b>Specifications for Multichannel Electrochemical Test Station</b>

4	<b>Application</b>	<ul style="list-style-type: none"> <li>Battery, Super capacitor, Corrosion, Electrodeposition, Electro catalysis</li> </ul>
5		<ul style="list-style-type: none"> <li>Electrochemical Impedance Spectroscopy Studies (EIS)</li> </ul>
6	<b>Configuration Design</b>	Multichannel Electrochemical Workstation with minimum 24 channels or more.
7	<b>General Description</b>	<ul style="list-style-type: none"> <li>Multi-channel Electrochemical work station for testing and evaluating Battery components in single / multiple unit cells simultaneously with high accuracy and precision</li> </ul>
8		<ul style="list-style-type: none"> <li>Chassis: Multichannel Single Chassis (Modular) expandable up to 80 Channels</li> </ul>
9		<ul style="list-style-type: none"> <li>High Precision Columbic Efficiency Determination</li> </ul>
10		<ul style="list-style-type: none"> <li>Grouping, Synchronising of At least 4 Channels should be possible</li> </ul>
11		<ul style="list-style-type: none"> <li>Electrochemical Impedance Spectroscopy (EIS) measurements at least on 8 channels with Equivalent Circuit Modelling</li> </ul>
12		<ul style="list-style-type: none"> <li>Internal Resistance Determination</li> </ul>
13		<ul style="list-style-type: none"> <li>Software Controlled Data Acquisition with Minimum Sampling rate</li> </ul>
14		<ul style="list-style-type: none"> <li>Temperature measurement on each cell should be possible</li> </ul>
15		<ul style="list-style-type: none"> <li>Cell Connection: 2, 3, 4, 5 electrodes (+ ground) or more and atleast 1.5m Cell cable</li> </ul>
16		<ul style="list-style-type: none"> <li>Compliance voltage: 12 V or better per channel</li> </ul>
17	<ul style="list-style-type: none"> <li>Applied Voltage: <math>\pm 10</math> V or better per channel</li> </ul>	
18	<ul style="list-style-type: none"> <li>Maximum Output Current: <math>\pm 400</math> mA or better at <math>\pm 10</math> V per channel</li> </ul>	
19	<ul style="list-style-type: none"> <li>Current Ranges: <math>\pm 10</math> nA to 400 mA or better</li> </ul>	
20	<ul style="list-style-type: none"> <li>Accuracy of applied and measured current: <math>\pm 0.1</math> % Full scale range or better</li> </ul>	
21	<ul style="list-style-type: none"> <li>Resolution of applied potential: 0.0015% or 1<math>\mu</math>V or better</li> </ul>	

22	<b>Specifications for Channels 1</b>	<ul style="list-style-type: none"> <li>• Voltage accuracy: 0.1 % of Full scale range or better</li> </ul>
23		<ul style="list-style-type: none"> <li>• Measured current resolution: 800 fA on lowest current range</li> </ul>
24		<ul style="list-style-type: none"> <li>• Potentiostat Rise/fall Time: &lt;1 <math>\mu</math>s or better</li> </ul>
25		<ul style="list-style-type: none"> <li>• Frequency range: 10<math>\mu</math>Hz to 6 MHz or better</li> </ul>
26		<ul style="list-style-type: none"> <li>• Impedance accuracy of 1% &amp; 1° at 1Hz</li> </ul>
27		<ul style="list-style-type: none"> <li>• Input Impedance: 1T<math>\Omega</math> or better</li> </ul>
28		<ul style="list-style-type: none"> <li>• Gain bandwidth range of amplifier: 1 MHz or better</li> </ul>
29		<ul style="list-style-type: none"> <li>• Bandwidth of electrometer: 1 MHz or better</li> </ul>
30		<ul style="list-style-type: none"> <li>• Input bias current: 20pA or better</li> </ul>
31		<ul style="list-style-type: none"> <li>• Acquisition speed: 1,00,000 samples/second</li> </ul>
32		<ul style="list-style-type: none"> <li>• Cyclic Voltammetry with scan rates 10 mV/Sec to 100V/Sec or better</li> </ul>
33		<ul style="list-style-type: none"> <li>• Floating mode Floating mode should be available Interface for connection with PC: Ethernet LAN</li> </ul>
34		<ul style="list-style-type: none"> <li>• Local Area Network to access Multiple Computers</li> </ul>
35		<ul style="list-style-type: none"> <li>• Possibility to upgrade to high current up to 30 A using external booster</li> </ul>
36		<b>Specifications for Channels 2 to 9</b>
37	<ul style="list-style-type: none"> <li>• Voltage range: 0-10 v or better for all channels</li> </ul>	
38	<ul style="list-style-type: none"> <li>• Voltage Accuracy: 0.01% or better</li> </ul>	
39	<ul style="list-style-type: none"> <li>• Voltage Control Resolution: 150<math>\mu</math>V or better</li> </ul>	
40	<ul style="list-style-type: none"> <li>• Max Current: <math>\pm</math>150 mA or more per channel</li> </ul>	
41	<ul style="list-style-type: none"> <li>• Min Current: at least 10 <math>\mu</math>A or better for all channels</li> </ul>	
42	<ul style="list-style-type: none"> <li>• Current Ranges: Must be provided with 4-5 ranges (100 mA to 10 <math>\mu</math>A)</li> </ul>	

43		<ul style="list-style-type: none"> <li>Automatic Current ranging should be available</li> </ul>	
44		<ul style="list-style-type: none"> <li>Current accuracy: 0.05% of FSR or better</li> </ul>	
45		<ul style="list-style-type: none"> <li>Current Control resolution: 800 nA or better for all channels</li> </ul>	
46		<ul style="list-style-type: none"> <li>Data Acquisition/ Sampling Rate: At least 2ms or better</li> </ul>	
47		<ul style="list-style-type: none"> <li>High Precision Coulometry measurements up to 10 ppm or better</li> </ul>	
48		<ul style="list-style-type: none"> <li>Cell Connections: 2,4 terminal leads</li> </ul>	
49	<b>Specifications for Channels 10 to 17</b>	<ul style="list-style-type: none"> <li>Voltage range: 0-10 v or better for all channels</li> </ul>	
50		<ul style="list-style-type: none"> <li>Voltage Accuracy: 0.01% or better</li> </ul>	
51		<ul style="list-style-type: none"> <li>Voltage Control Resolution: 150<math>\mu</math>V or better</li> </ul>	
52		<ul style="list-style-type: none"> <li>Max Current: <math>\pm</math>1.5 A or more per channel</li> </ul>	
53		<ul style="list-style-type: none"> <li>Min Current: At least 0.1 mA or better for all channels</li> </ul>	
54		<ul style="list-style-type: none"> <li>Current Ranges: Must be provided with 4-5 ranges (1 A to 0.1 mA)</li> </ul>	
55		<ul style="list-style-type: none"> <li>Automatic Current ranging should be available</li> </ul>	
56		<ul style="list-style-type: none"> <li>Current accuracy: 0.05% of FSR or better or better</li> </ul>	
57		<ul style="list-style-type: none"> <li>Current Control resolution: 8<math>\mu</math>A or better for all channels</li> </ul>	
58		<ul style="list-style-type: none"> <li>Data Acquisition/ Sampling Rate: At least 2ms or better</li> </ul>	
59		<ul style="list-style-type: none"> <li>Cell Connections: 2, 4 terminal leads</li> </ul>	
60		<ul style="list-style-type: none"> <li>High Precision Coulometry measurements up to 10 ppm or better</li> </ul>	
61		<ul style="list-style-type: none"> <li>EIS (Electrochemical Impedance Spectroscopy) All the 8 channels should have EIS</li> </ul>	
62		<ul style="list-style-type: none"> <li>EIS Frequency Range 10mHz – 10Khz or better</li> </ul>	
63			<ul style="list-style-type: none"> <li>Voltage range: 0-9 V or better for all channels</li> </ul>
64			<ul style="list-style-type: none"> <li>Voltage Accuracy: at least 0.4mV or better for all channels</li> </ul>
65			<ul style="list-style-type: none"> <li>Voltage Control Resolution: 200<math>\mu</math>V or better for all channels</li> </ul>

66	<b>Specifications for Channels 18 to 25</b>	<ul style="list-style-type: none"> <li>• Max Current: <math>\pm 15</math> A or more per channel</li> </ul>
67		<ul style="list-style-type: none"> <li>• Min Current: at least 1mA or better for all channels</li> </ul>
68		<ul style="list-style-type: none"> <li>• Current Ranges: Must be provided with 4-5 ranges (ranging few mA to 10A)</li> </ul>
69		<ul style="list-style-type: none"> <li>• Automatic Current ranging should be available</li> </ul>
70		<ul style="list-style-type: none"> <li>• Current accuracy: 0.05% of FSR or better</li> </ul>
71		<ul style="list-style-type: none"> <li>• Current Control resolution: <math>\leq 100</math> nA or better for all channels</li> </ul>
72		<ul style="list-style-type: none"> <li>• Data Acquisition/ Sampling Rate: Minimum 2ms</li> </ul>
73		<ul style="list-style-type: none"> <li>• Channel Parallel Ability up to 100A (suitable current collector module/device/attachment is to provide with Cables)</li> </ul>
74		<ul style="list-style-type: none"> <li>• Cell Connections :2, 4 terminal leads</li> </ul>
75		<ul style="list-style-type: none"> <li>• High Precision Coulometry measurements up to 10 ppm or better</li> </ul>
76		<ul style="list-style-type: none"> <li>• Provision to measure Temperature from <math>-25</math> °C to <math>200</math> °C with accuracy of <math>\pm 2</math> °C</li> </ul>
77		<ul style="list-style-type: none"> <li>• Galvanostatic Charge / Discharge (Including C rate control) with voltage vs. time Graph plots</li> </ul>
78		<ul style="list-style-type: none"> <li>• Multigraph window capable of displaying up to 10 graphs within a single window</li> </ul>
79		<ul style="list-style-type: none"> <li>• Customize variables graph plot for each axis</li> </ul>
80	<ul style="list-style-type: none"> <li>• Voltage vs. Capacity plot during Charge/Discharge Cycles</li> </ul>	
81	<ul style="list-style-type: none"> <li>• At least 3 limits and 3 recording conditions per sequence/cycle (ability to limit a cycle or changeover to next sequence with Time, Voltage/Current, Charge/Power all simultaneously)</li> <li>• Multiple recording conditions</li> <li>• Industrial CC-CV Method (Constant Current – Constant Voltage)</li> </ul>	

82	<b>Complete battery cycling software facility with following specifications</b>	<ul style="list-style-type: none"> <li>• Cyclic Voltammetry, Current Scan (Current/Galvano Dynamic), Voltage Scan (Potentio Dynamic) Constant Power / Constant Resistance</li> </ul>
83		<ul style="list-style-type: none"> <li>• GITT and PITT Techniques</li> </ul>
84		<ul style="list-style-type: none"> <li>• Columbic Efficiency Determination with fitting tool</li> </ul>
85		<ul style="list-style-type: none"> <li>• Current Interrupt</li> </ul>
86		<ul style="list-style-type: none"> <li>• Rest Time</li> </ul>
87		<ul style="list-style-type: none"> <li>• Multiple loops</li> </ul>
88		<ul style="list-style-type: none"> <li>• Provision to connect and control External devices like Furnace, Thermal chambers</li> </ul>
89		<ul style="list-style-type: none"> <li>• Monitoring status of each Channel using Global Table/Summary Table</li> </ul>
90		<ul style="list-style-type: none"> <li>• Option to update the experimental setting parameters on current running experiment without pausing/stopping the channel/experiment</li> </ul>
91		<ul style="list-style-type: none"> <li>• Profile Importation to study Urban Life Cycle Tests</li> </ul>
92		<ul style="list-style-type: none"> <li>• Analysis tools like Integral, Circular or linear fit and Electrochemical EIS - Z fit should be available</li> </ul>
93		<b>Electrochemical Impedance Spectroscopy (EIS)</b>
94	<p>Simultaneous impedance measurement at counter electrode and working electrode.</p>	
95	<ul style="list-style-type: none"> <li>• Pouch cell r Holder - 4 nos.</li> </ul>	
96	<ul style="list-style-type: none"> <li>• Cylindrical cell Holder - 1 nos.</li> </ul>	
97	<ul style="list-style-type: none"> <li>• 2032 Coin cell holder - 8 nos.</li> </ul>	



98	<b>Accessories:</b>	<ul style="list-style-type: none"> <li>• Temperature probes - 4 Nos</li> </ul>
99		<ul style="list-style-type: none"> <li>• Alligator clip for 8 channels (red 2mm, blue 2mm, red 4mm, blue 4mm)-1 no</li> </ul>
100		<ul style="list-style-type: none"> <li>• Cell Cables – 24 Nos (at least 1.5 metre. long)</li> </ul>
101	<b>Indigenous items</b>	<ul style="list-style-type: none"> <li>• Customized test chamber with Temperature control 10°C to</li> </ul>
102		60°C: 1no
103	<b>Computer</b>	<ul style="list-style-type: none"> <li>• Branded PC i7, 16GB RAM, 1TB, HDD, 19 inch or higher</li> </ul>
104		LED Monitor, Windows 10 OS: 2 nos.
105	<b>Warranty</b>	One Years Standard Warranty after installation and commissioning
106	<b>Maintenance he system has its</b>	The channels Should be plug & play type and easy to install or to be removed.
107	<b>Dummy Cell</b>	Dummy cell to be provided for internal validation.
108	<b>Optional</b>	<ul style="list-style-type: none"> <li>• Necessary clips for Pouch cell, Cylindrical cell, Coin cell, Alligator clips - 50 Nos</li> </ul>
109		<ul style="list-style-type: none"> <li>• Platinum electrode-2</li> </ul>
110		<ul style="list-style-type: none"> <li>• Ag/AgCl-2</li> </ul>
111		<ul style="list-style-type: none"> <li>• Saturated Calomel Electrode -2</li> </ul>
112		<ul style="list-style-type: none"> <li>• Hg/HgO-2</li> </ul>
113		<ul style="list-style-type: none"> <li>• Hg/HgSO4-2</li> </ul>
114		<ul style="list-style-type: none"> <li>• Corrosion Cell Kit</li> </ul>
115		<ul style="list-style-type: none"> <li>• Three electrode cell set-up</li> </ul>
116		<ul style="list-style-type: none"> <li>• Polishing kit</li> </ul>
117		<ul style="list-style-type: none"> <li>• RRDE</li> </ul>

**2021-22/02/42 Optical Blue Light 3D Scanner**

S. no.	Item	Specification
1	Resolution	Dual camera 8 MegaPixel system with blue light projector
2	Light Source	Optical Blue LED light based 3D Scanning system.
3	Measuring Volume	Minimum 2 measuring volume to cover small part to large size part upto 2 mtrs.
4	Acquisition Time	Should be 2 seconds or better
5		To be reported as per VDI 2634 – Part 3 with following accuracy for different Scanning volumes as below:
6		MV 170
7		a. Probing Error Form 0.005 mm

8	System Accuracy	b. Probing Error Size 0.012
9		c. Spacing Error 0.014
10		MV 600
11		a. Probing Error Form 0.010
12		b. Probing Error Size 0.029
13		c. Spacing Error 0.035
14	Data Transmission	Between sensor and data acquisition system should be through Ethernet or Thunderbolt
15	LED Bulb Life	Minimum 10,000 hours or better
16	Calibration	Certified calibration plates covering all measurement volumes to be supplied
17	Transport Box & Casing	Transport box and casing to be supplied
18		Supplied Mounting and Handling system of the Sensor could be handled by a single person.
19		High quality height adjustable Studio stand with manual tilt axis for quick and easy manual sensor positioning. The tripod should be equipped with high-quality and smooth-running wheels for maximum maneuverability.
20	Mounting and Handling System	Scanner should have 10 meter sensor cable
21	Rotary Table	Rotation of rotary table should be auto-synchronised with scanning software.
22		One axis rotary table of diameter 300 mm (minimum) and load capacity 20 kg (Minimum) to be supplied. Resolution: 1° (or better), RPM- 7
23	Guided Pointers	The system should be equipped with guided pointers for setting of optimum standoff distance
24	Stand-off Distance	500 -700 mm
25	Fields of View and Component Size to Cover	System should be upgradable with the ability to change only the lenses – if necessary, for adapting for different fields of views (FOV).
26		No manual setting of focus is needed, either at projector or at camera.
27	Operating Conditions	The instrument should be capable of operating at 10 to 40 deg C temperature and Relative humidity 55% or less with no condensation.
28	Merging Scanned Data	Should have the ability to merge scanned data using different methods

29	Merging Scanned Data	Merging of back or front side should be with or without use of reference marker
30	GD & T Analysis	All GD & T measurements as per ISO and ASME (User selectable)
31	Datum Creation	Should facilitate datum creation and local coordinate system
32	Sectional analysis	Color base sectional analysis with uniform and non-uniform tolerance band
33	2D Analysis	Tolerance and deviation Computations for sections and surfaces
34	Report Format	Should be capable of graphical report presentation in pdf
35	Import CAD Data Formats	IGES and STEP
36	Import of point clouds and polygons	OBC, ASC, TXT, STL, PLY
37	Export of point clouds and polygons	ACS, POL, STL, TXT
38	Data export to statistics Programs	CSV format
39	3D Comparison	3D comparison with CAD/Mesh to generate color report.
40	After Sales Support	All kind of After Sales support including Repairs, Calibration, Spares, etc. should be locally available in India & OEM Authorization letter for the same should be provided.
41	Auto Exposure	Automatic monitoring of calibration, transformation, movement and positioning for each single measurement
42	CAD Alignment	The software shall have all the latest CAD based alignment features like automatic pre-alignment against CAD, alignment using 3-2-1, Best Fit with Tolerance, RPS, Plane-Line-Point, local best fit, etc. Tolerance definition on the CAD data should be possible
43	Draft Angle Analysis	Should be able to do draft angle analysis in color
44	Gap & Flush Analysis	The software should be capable of evaluating flush & gap between mating parts & curve based analysis should be possible. Character line, bending distance, radius analysis, hemmed edge analysis, trim line & spring back analysis should be possible
45	Hardware & Software Make	Should be from same make software and hardware for hassle free and smooth operations in future.
46	Material Thickness Analysis	Full-surface computation of material thickness based on polygon meshes

47	Onsite Calibration	VDI 2634 – Part 3 Calibration & accuracy certification should be done at on site.
48	Surface Defect Analysis	Surface defect analysis and classification to determine surface quality of sheet metal and plastic shall be possible in the inspection software.
49	Curve Bases Analysis	Should be able to do character curve and curvature analysis
50	GD&T Form Deviation	Color plot presentation of form error feature of GD&T (flatness, roundness etc) on points and mesh data
51	Strain Analysis	System should be capable to do strain analysis for material testing with add on software (Hardware same)
52	User Reference	The supplier should have supplied similar systems to at least 5 premier government organizations like ISRO, HAL, DRDO, CIPET, CTTCs, NITs & Central Universities.
53		Software should be parametric. Software should be capable of 3D data acquisition, processing and 3D color comparison as well as 2D comparison
54		System should be capable to do large size part with add on photogrammetry system upto 10metre.
55		The software shall provide online display of sensor position and live image mapping
56		Data acquisition and inspection software should be from in-house development of the manufacturer in an integrated suite of software. No add on third party software should be required to do the mentioned inspection functions.
57		Automatic transformation by measurement data by reference points or best fit of surface
58		Import /Export of scan data in STL, ASCII, POL etc
59		Mesh editing by filling holes, smooth, thinning, repairing etc
60		Facility of Augmented view for inspection report
61		Import of CT volume data (VGI, VGL, PCR, EXV, REK) as a polygon mesh

62		Complete geometric measurement such as point, line, circle, slot, rectangle, vector, plane, cylinder, sphere, cone etc.
63		Fitting elements feature (maximum inscribed and minimum circumscribed elements, Gaussian and Chebyshev methods) should be possible
64		Tracing and evaluation of curvatures and character lines
65		Silhouette section facility for 2D inspection
66		Multisections (axis parallel, radial, along curves and in viewing direction)
67		Cylindrical /conical base section and unroll section
68		Distance measurement using virtual caliper shall be possible. Software shall be capable to calculate curve length.
69	Other Features of the Software	The measuring software shall provide complete set of indirect measurement for intersection, distance, angle, symmetry etc. Volume & Surface area evaluations should be possible in inspection software
70		Curve base analysis like flush and gap, curvature etc
71		Evaluation of GD&T according to DIN ISO 1101 and ASME Y14.5 should be possible in software. All parameters like flatness, Theoretically Exact Dimension (TED) Pattern, cylindricity, concentricity, roundness, run-out, total run-out should be evaluated by the software.
72		The software shall provide polygonization of random point clouds into polygon meshes.
73		Multiple alignment with hierarchical order in same project should be possible.
74		Tracing and evaluation of curvatures and character lines
75		Complete traceability of constructions and evaluations`

76		This software shall be able to construct equidistant multiple points on areas or along edges. It should be capable to evaluate collective sections like axis parallel, radial and along curves. Intersection, projection, perpendicular dropping and averaging of features shall be possible.
77		Multiple copy of analysis software for report creation .No need to keep scanner ideal for analysis and report.
78		Analysis of material allowance control shall be available in the software.
79		Software should be certified by PTB & NIST.
80		Able to find surface and Section enclosed area
81		Analysis of bending distance, radius analysis, hemmed edge analysis, trim line & spring back should be possible
82		Arc length and continuous curve distance for analysis of deviation.
83		Should have disk and edge caliper for distance measurement.
84	Laptop	Latest configuration Workstation laptop with minimum 64GB RAM
85	Technical updates	Availability of information on technical update such as updated software, case studies, feedback from other customers etc. for effective utilization of the system on a regular basis.
86	Documentation	· Operational Manual (User Manual)
87		· Software Instruction Manual
88		· Maintenance and troubleshooting Manual
89		· Training Manual
90		· Installation and Commissioning
91		· Handling of accessories
92		· Software key (for operation, if any)
93		· Software CDs
94	Calibration Plates	· Calibration Plate with International STD VDI Certification for all FoV
95		· Periodic calibration of the artefact during and subsequent to expiry of warranty at a periodicity of one year for a period of five years to be indicated.

96	Any other Accessories	Any other Accessories, if available for better utilization - Bidder to specify and quote
97	System	The System shall be catalogued items from a company. All the relevant catalogues shall be enclosed in the technical bid.
98	Scope of supply	Attach list for scope of supply
99	Installation requirements	Bidder to specify , pre-installation requirement
100	Installation & Training	Basic and Advanced training should be provided a minimum 6 days
101	Technical support and service	Availability of technical support in the area of application and service both within the country. The tenderer shall have local service and application office and infrastructure to attend by visit within 48 hours of need.
102	Manufacturer's credential	Should have installations of same model worldwide and at least Three similar model sold in Private and Government sectors, Attached OLD PO's for REF

**2021-22/02/43 Plasma Cleaner**

S. no.	Item	Specification
1	APPLICATION	Surface cleaning and modification of variety of materials, including glass, semiconductors, polymers, and metals.
2	• Compact and benchtop unit	
3	• Adjustable radio frequency (RF) power settings: Low, Medium, High	
4	• Maximum RF power of 30W or better	
5	• Pyrex chamber: Dimension not less than 6" diameter x 6.5" length	
6	• System should include hinged door with viewing window and integral switch for a vacuum pump.	
7	• System should have active fan cooling	
8	• Integral switch for a vacuum pump	

9	<ul style="list-style-type: none"> <li>The metering valve should be able to qualitatively control the gas flow and chamber pressure; it should have 1/8" national pipe thread (NPT).</li> </ul>	
10	<ul style="list-style-type: none"> <li>A 1/8"NPT 3-way valve should be there for quick in bleeding of gas, isolating the chamber and ventilating.</li> </ul>	
11	<ul style="list-style-type: none"> <li>Gas mixer allows quantitative control of up totwo process gases and monitoring of vacuum pressure.</li> </ul>	
12	<ul style="list-style-type: none"> <li>2 No of Quartz chamber and sample tray.</li> </ul>	
13	<ul style="list-style-type: none"> <li>Suitable Vacuum Pump for Plasma Cleaner with following specifications: Oxygen compatible vacuum pump with a minimum pump with ultimate total pressure (closed) of 100m Torr or less. The dry (oil free) vacuum pump should able to pump oxygen, air, nitrogen and argon. Pump should include inlet hose, hose clamps, hose adaptor, centering ring and swing clamp to connect plasma cleaner to pump inlet.</li> </ul>	
14	<ul style="list-style-type: none"> <li><b>Power:</b> 230V AC <math>\pm</math> 10%, Single phase and 50 Hz.</li> </ul>	
15	<ul style="list-style-type: none"> <li>Minimum 2 yearcompliance warranty with additional 1 year's maintenance warranty must be provided in order to keep the equipment in continuous working condition.</li> </ul>	

**2021-22/02/44 Probe Sonicator**

S. no.	Item	Specification
1	APPLICATION	<ul style="list-style-type: none"> <li>It is used to synthesis various nanomaterials</li> </ul>
2		<ul style="list-style-type: none"> <li>Disperse solids, de-agglomeration of powders, degassing of liquids, emulsion preparation, acceleration of chemical reaction, dissolving powders/solids, protein extraction etc.</li> </ul>



3	<b>Configuration :</b>	<ul style="list-style-type: none"> <li>• Micro Processor controlled Ultrasonic Probe Sonicator (Digital)</li> </ul>
4	<b>Specification</b>	<ul style="list-style-type: none"> <li>• Power: 750 watt or more</li> </ul>
5		<ul style="list-style-type: none"> <li>• Frequency:Up to 20 kHz or more</li> </ul>
6		<ul style="list-style-type: none"> <li>• Energy monitor</li> </ul>
7		<ul style="list-style-type: none"> <li>• Full function Pulser – ON and OFF cycle independently controllable from .1 to 10 seconds</li> </ul>
8		<ul style="list-style-type: none"> <li>• Full function Pulser – ON and OFF cycle independently controllable from .1 to 10 seconds</li> </ul>
9		<ul style="list-style-type: none"> <li>• Pulse mode with full function ON and OFF cycle. Continuous mode up to 30 minutes or preferably more</li> </ul>
10		<ul style="list-style-type: none"> <li>• Variable amplitude control</li> </ul>
11		<ul style="list-style-type: none"> <li>• Replaceable probe tip – Size : ½” (13 mm)</li> </ul>
12		<ul style="list-style-type: none"> <li>• Digital amplitude / Intensity control : Output amplitude can be set from 10 to 100%</li> </ul>
13		<ul style="list-style-type: none"> <li>• Temperature controller integratable</li> </ul>
14		<ul style="list-style-type: none"> <li>• Elapsed time indicator should indicate both elapsed time and actual duration of processing</li> </ul>
15	<b>Probe material</b>	<ul style="list-style-type: none"> <li>• Titanium alloy</li> </ul>
16	<b>Display parameters</b>	<ul style="list-style-type: none"> <li>• Energy monitor, Watt meter, Amplitude, Time indicator, Pulser and Temperature</li> </ul>
17	<b>Processing Volume</b>	<ul style="list-style-type: none"> <li>• 10 ml – 1000 ml</li> </ul>
18	<b>Accessories</b>	<ul style="list-style-type: none"> <li>• Suitable sound abating enclosure</li> </ul>
19		<ul style="list-style-type: none"> <li>• Temperature probe – 1</li> </ul>
20		<ul style="list-style-type: none"> <li>• 19 mm probe</li> </ul>
21		<ul style="list-style-type: none"> <li>• stepped microtip probe of 2 mm</li> </ul>
22		<ul style="list-style-type: none"> <li>• Toolkit for replacing different probes</li> </ul>
23	<b>Safety</b>	<ul style="list-style-type: none"> <li>• Overload protection circuit</li> </ul>
24	<b>Power</b>	<ul style="list-style-type: none"> <li>• 230V AC ± 10%, Single phase and 50 Hz.</li> </ul>

**2021-22/02/45 Rockwell Hardness Tester**

S. no.	Item	Specification
1	Purpose	To determine the comparative depth of indentations of the different types of polymeric material.

2	Principle/ Definition	Resistance of solid matter to various kinds of permanent shape change when a compressive force is applied.
3	Reference Standard	Should be complied to ASTM D 785, IS:1586- 2000
4	Display and Operation panel	LCD / LED Colour display panel. Automatic weight selection with automatic zero setting dial gauge
5	Test Force Rockwell or Load	Minor load: 3 & 10 kgf
6		Major load: 5, 15, 30, 45, 60, 100, 150 kgf
7	Preliminary Test Force	Minor load auto-brake system
8	Total Test Force Control	Automatic (loading, duration, unloading)
9	Dwell time	Minor Dwell Time: adjustable 0.1 to 60s or better
10		Major Dwell Time: adjustable 1.0 to 60s or better
11	Hardness Test Cycle Tolerances	Test Cycle Time: Test cycle time shall meet table 3 of ASTM E18-15 requirements.
12		Test load holding time: Optionally settable over a range from 0 to 99 seconds. This time to be set to 3 seconds at the time of delivery.
13		Indenter Contact Velocity: Indenter Contact Velocity shall be <2.5 mm/seconds
14		Total Measuring Time: Approx. 15 seconds / cycle
15	Max. Test Height (mm)	250 and above
16	Depth of Throat (mm)	150 and above
17	Hardness Minimum Value	0.1 HR (adjustable)
18	Rockwell Hardness Scales to be tested	HRA, HRB, HRC, HRE, HRF, HR15N, HR30N, HR45N, HR15T, HR30T, HR45T
19	Scale Conversions	Advanced with corrections
20	Data Output	USB or RS-232C or Centronics for easy data transfer to MS Excel or other applications
21	Power Supply	120V AC ( $\pm 10\%$ ), 60Hz
22	Accessories	• Additional indenters and standard test blocks.
23		• Indenter and test block should be certified by any one of these (DKD, UKAS, NABL)
24		While supplying the Machines, the supplier should also provide the following items apart from above:
25		• Hard copies of Operational & Service Manual- 01 Set.

26	Other Mandatory Items	<ul style="list-style-type: none"> <li>Machine should come with all other essential accessories, computer &amp; spares required for installation, commissioning &amp; Operation</li> </ul>
27		<ul style="list-style-type: none"> <li>Compliance to ASTM D-785</li> </ul>
28		<ul style="list-style-type: none"> <li>Onsite Training to be provided for CIPET staff at commissioning site.</li> </ul>

**2021-22/02/46 Salt Spray Chamber**

S. no.	Item	Specification
1	<b>APPLICATION</b>	<ul style="list-style-type: none"> <li>Worldwide, materials used by manufacturing industry are exposed to natural or industrial corrosion in shape of salt fog.</li> </ul>
2		<ul style="list-style-type: none"> <li>Laboratory corrosion tests are used extensively for selection of materials and their surface protection. Salt spray chambers are what you need to predict corrosion resistance of materials such as paints and coatings.</li> </ul>
3	<b>Configuration :</b>	<ul style="list-style-type: none"> <li>Salt spray chamber in vertical model</li> </ul>
4	<b>All Specification</b>	<ul style="list-style-type: none"> <li>Overall dimensions (mm) 1320 x 780 x 1450 (W x D x H)</li> </ul>
5		<ul style="list-style-type: none"> <li>Test chamber internal dimensions (without dome area) (mm) 800 x 700 x 800 (W x D x H)</li> </ul>
6		<ul style="list-style-type: none"> <li>Test chamber internal volume (without dome area) (litres) 448</li> </ul>
7		<ul style="list-style-type: none"> <li>Salt solution reservoir capacity (litres) 110</li> </ul>
8		<ul style="list-style-type: none"> <li>Salt solution reservoir capacity - Min. 100 Litres</li> </ul>
9		<ul style="list-style-type: none"> <li>Capable of holding specimen weighing atleast 4 kg.</li> </ul>
10		<ul style="list-style-type: none"> <li>Type of connection Electrical: 1/N/PE</li> </ul>
11		<ul style="list-style-type: none"> <li>Type of water: demineralised</li> </ul>
12		<ul style="list-style-type: none"> <li>Water pressure: 2-4 bar</li> </ul>
13		<ul style="list-style-type: none"> <li>Water consumption (approximate) (litres/day) 3</li> </ul>
14		<ul style="list-style-type: none"> <li>Type of air : Filtered, oil free</li> </ul>
15		<ul style="list-style-type: none"> <li>Air pressure: 4-6 bar</li> </ul>
16		<ul style="list-style-type: none"> <li>Air consumption (approximate) (Nm<sup>3</sup>/h) 5-8</li> </ul>
17		<ul style="list-style-type: none"> <li>Test chamber temperature range (°C) : Ambient to 50</li> </ul>

18		<ul style="list-style-type: none"> <li>• Temperature accuracy: 0.1°C</li> </ul>
19		<ul style="list-style-type: none"> <li>• Temperature Repeatability: <math>\pm 2</math> °C</li> </ul>
20		<ul style="list-style-type: none"> <li>• Humidifier temperature range (°C): Ambient to 70</li> <li>Power: 230V AC <math>\pm 10\%</math>, Single phase and 50 Hz.</li> </ul>
21	<b>Material</b>	<ul style="list-style-type: none"> <li>• Strong structure overall 10mm thick polypropylene construction with built-in salt solution reservoir. Material should be capable of withstanding salt corrosion</li> </ul>
22	<b>Display parameters</b>	<ul style="list-style-type: none"> <li>• Free programming, up to 15 different test programs, inputs via keyboard with soft keys and easy to use structure of the Menu. Test status should be continuously displayed on the large LCD display with 4 lines of 20 characters each. Control and monitoring of test chamber and humidifier temperature, monitoring of nozzle air pressure and dosing pump RPH. Self-diagnostic including warning messages, alarm messages and safety shut down.</li> </ul>
23		<ul style="list-style-type: none"> <li>• Complete test report: chamber and humidifier temperature, nozzle air pressure and dosing pump RPH are periodically measured and stored in the controller memory together with test interruptions or alarms. By simply pressing a key a complete report of the test is printed.</li> </ul>
24	<b>Accessories</b>	<ul style="list-style-type: none"> <li>• Rods</li> </ul>
25		<ul style="list-style-type: none"> <li>• Test panel racks</li> </ul>
26		<ul style="list-style-type: none"> <li>• Air filter and pipe</li> </ul>
27		<ul style="list-style-type: none"> <li>• Thermo couple</li> </ul>
28		<ul style="list-style-type: none"> <li>• Compressor</li> </ul>
29		<ul style="list-style-type: none"> <li>• Dosing pump</li> </ul>
30	<b>Safety</b>	<ul style="list-style-type: none"> <li>• Overload protection circuit</li> </ul>
31	<b>Standard</b>	<ul style="list-style-type: none"> <li>• Equipment shall comply to ASTM B 117</li> </ul>
32	<b>Calibration</b>	<ul style="list-style-type: none"> <li>• Calibration certificate with NIST traceability for Temperature controller, Solution spray rate, air pressure, etc. is essential.</li> </ul>

**2021-22/02/47 Selective Laser Sintering - PolymerPlastic**

S. no.	Item	Specification
<p>Technical Specifications for Selective Laser Sintering - Polymer/Plastic</p> <p>The latest model and version of Selective Laser Sintering 3D printer that shall be capable of producing Plastic components with several material option from wide range of Plastic powders such as nylon (polyimide), glass filled polyimide etc., for functional testing. The 3D printing system consists of process unit with High Performance Control Computer and System Monitor, Thermal Control System and Real Time Monitor System, Large Range of Laser Sintering Materials for multiple solutions and accessories. This machine should allow highly individualised products to be manufactured in exceptional quality with latest technology. The detailed technical specifications are as below:</p>		
1	Technology	<p>Powder based additive manufacturing system</p> <p>(Latest Selective Laser Sintering system)</p>
2	Build Volume	<p>Minimum build volume 200 x 200 x 200 mm or more</p> <p>Complete build volume to be achieved without stopping the building process.</p>
3	Layer thickness	0.06– 0.12 mm or better
4	Build volume rate	1.2L/hr or better
5	Scan speed	Scan speed with max of 5m/s
6	Min wall thickness	1 mm or Better
7	Laser type	CO <sub>2</sub> , 30 W or better
8	Build environment temperature	Temperature of the build chamber to be maintained close to the melting point of the processed material& each layer to be heated to achieve better mechanical strength.
9	Machine Architecture	To avoid down time after every build the machine should be capable to replace the part build chamber for next build.
10	Recoating	Double side recoating with hopper like arrangement to spread the powder uniformly & different blades depending on the build requirement like surface & good strength etc. to be quoted.
11	Powder feed	Required powder quantity should be calculated automatically & feed to the re-coater in order to spread the powder in the build area. Manual Top loading of powder to ensure that the powder can be loaded when the process is running to build the complete build volume. For quick change of material vendor should provide an extra powder dispensing unit. Automatic change over of the powder dispensing bin when one is empty.

12	Laser cooling system	Suitable cooling system to be included in the scope of supply.
13	Machine Control	Real time computer to control the system components for easy accessibility
14	Material	Wide variety of material option and capable to use all type of materials such as polyimide (Bio-compatible), glass filled polyimide PP (Bio-compatible), composite material, Polystyrene with 0.002% ash content, and new materials. RoHS certificate to be enclosed for Non Toxic Materials & Processes. Vendor to submit Bio-compatibility certificates for PA & PP.
15	Parameter set module for the laser power(s)	Documented laser sintered properties according to standards of the quoted material should be available .Material data sheet to be provided.
16	Parameter Editor Module	Complete package of process Parameter Editor to optimize parts results.
		Vendor to confirm that all parameters that are required to build a part is user controllable, and if not, to list what is not accessible.
		Also vendor should provide training on build Parameter Editing. The syllabus of this training should be clearly defined so that the user knows what is being offered.
17	Powder material	To supply 100 Kgs of each material. Powders should be reusable for better economics
18	Process Software	To control the building process and ergonomic operating interface of the touch screen.
19	Slicing and data editing software	Complete module for conversion of part data in the STL format and optimization of layer data.
20	Working zone	Closed (with a view glass)
21	Language	Multilingual
22	Connectivity	USB, LAN
23	Software feature	3D nesting should be possible.
24	License	License must be perpetual

25	Process control desktop software	Independent process software to be supplied for the build data to be prepared & to evaluate the total build time that would be required to finish the job.
26	Workstation with accessories	Vendor should supply suitable OEM workstation computer system with complete accessories and UPS. It should have minimum of i7 (3.4 GHz, quad core) processor of latest configuration, 64GB RAM (2400MHz, DDR4), 1TB hard disk (7200 RPM), and 4GB graphics card or better configuration, with windows operating system
27	Nitrogen Generator	System should have inbuilt Nitrogen generator for economic purposes
28	Vacuum Cleaner	Suitable Vacuum Cleaner - Bidder to specify and quote.
29	Process Station	Semi Automating uppacking/Sieving and complete accessories for maximum safety and minimum material contamination. - Bidder to specify and quote.
30	Sand blasting	Suitable sand blasting machine to specify and quote.
31	Online UPS	Suitable UPS with minimum 60 minutes backup power for the machine. - Bidder to specify and quote.
32	De-humidifier	As per the requirement, Bidder to specify and quote.
33	Compressor (Silent operation)	As per the requirement, Bidder to specify with details and quote.
34	Lifting and handling truck	Suitable system if necessary for the machine - Bidder to specify and quote.
35	Additional Accessories	Bidder should specify and quote if any other items required for better utilisation of machine.
36	Tool Kit	Standard tools/kits for start-up, removal of parts and cleaning (list to be attached).
37	Powder Material	Inspection certificate of the material with test certificate evaluating the grain size distribution, bulk density etc according to standards should be supplied.
38	Benchmark part	Part geometry to be provided.

39	Installation requirements	State space required and condition of floor and any other requirement for installation of the machine and equipment.
40	Installation & Training	Onsite training (Basic & Advanced level) including providing two sets of operating and maintenance manuals and other reference
		manuals for getting quality output and longer trouble free life of machine.
		Basic & Advanced level training schedule and plan to be submitted
41	Manufacturer's credential	Should have minimum 3 installations of the same model in India & The manufacturer should have independent office in India for a min of 10 years.
42	References	Tenderer shall give complete contact details of existing customers having such supply in India.
43	Safety requirements	Suitable safety gear to be recommended by the supplier.
44	Environment protection	Safe to use without emission of any hazardous gases, noise level, radiation etc. without any need for additional equipment, provision or training and meet current international standard.
45	Consumption of other consumables	List all such material that will be used in building prototype
46	Availability of spares and consumables	Tender shall include list of all essential spares and consumables to be provided with replacement time prescribed for each such item and its availability within reasonable time period. In case if any such item is likely to be out of availability within service period of machine, such item shall be included in initial supply.
47	Price list of material, spares and consumables	Price list of each material should be fixed for next 3 years from the date of PO.



48	Technical support and service	Availability of technical support in the area of application and service both within the country from OEM. The tenderer shall have local service and application office and infrastructure to attend by visit within 48 hours of need. OEM should have min. 5 years' experienced service/application engineer. Vendor to submit the credentials of service/application personals.
49	Software license	The entire software license must be perpetual.
50	Retrofits	Free hardware Retrofits and software updates till the life of machine.
51	Scope of supply	Tenderer will supply complete start up package necessary to prove the machine and provide training. List for scope of supply (with make model, quantity of each items) to be submitted.

**2021-22/02/48 Semiconductor measurement with Probe Station**

S. no.	Item	Specification
1	<b>Purpose</b>	An Electrical Characterization System to perform device characterization, real-time plotting, and analysis with high precision and resolution, while remaining a highly integrated, flexible, upgradable and user-friendly package.
2		The system should be capable to perform the I-V and C-V characterization of Thin Films, Electronic materials, Semiconductor devices, Solar Cells, High resistive materials and nano materials etc.
3	<b>Features</b>	<ul style="list-style-type: none"> <li>• Single box solution for current-voltage (IV), CV, pulse generation upgradable (Fast IV) capability with built in PC.</li> </ul>
4		<ul style="list-style-type: none"> <li>• Slot system for Source measure unit (SMU), Capacitance-voltage unit (CVU) and pulse IV modules.</li> </ul>
5		<ul style="list-style-type: none"> <li>• Should be compatible with automatic/semiautomatic prober.</li> </ul>

6		<ul style="list-style-type: none"> <li>All SMU should provide voltage/current in Bias; Common; Sweep; List sweep (custom point-by-point user-defined sweep); Step mode.</li> </ul>
7		<ul style="list-style-type: none"> <li>SMU should be able to apply pulse in mS range.</li> </ul>
8	No of SMU	3 expandable up to 9
9	Type of SMU	High Power -1; Medium-2
10	Display	Built in 12.5 TFT display or better
11	Voltage Source and measure range	200 mV to 200V or better
12	Voltage Resolution	Source: 5 $\mu$ V and measure: $\pm$ 200nV or better
13	Current Source and measure ranges	1 pA to 100mA or better
14	Current Resolutions	Source: 1.5pA Measure: $\pm$ 100 aA or better
15	Built in C-V Measurement capability	Frequency Range:1KHz to 10 MHz variable.
16		DC Voltage Bias: + / - 30V / 1mV resolution.
17		Measurement Parameters:CS-GS, CP-GP, Z theta, Cs-D, Cp-D, R+jX
18	System should have Very Low Frequency CV capability.	Frequency range: 10 mHz to 10 Hz.
19		Voltage: up to 200 V.
20		VLF measurement models: CS-GS, CP-GP, Z theta, Cs-D, Cp-D, R+jX.
21	Hardware/ Architecture	In-Built PC platform with windows-OS, having LAN; GPIB; USB; RS232; parallelport; HDD,CD-RW; Should provide libraries / projects for measurement of device parameters for semiconductors.
22	Power requirement	230V AC, +/- 10%; 50Hz.
23	Accessories	Low Noise Triax Cable-03
24		Piv Demo Fixture

**2021-22/02/49 Shore harness tester A & D**

S. no.	Item	Specification
1	Purpose	It is an instrument which is used to measure the hardness of a material. Hardness may be defined as a material's resistance to permanent indentation.
2	Principle/ Definition	Resistance of solid matter to various kinds of permanent shape change when a compressive force is applied.

3	Reference Standard	Should be complied to ASTM D2240, ISO 7619, ISO 868	
4		<b>Shore A</b>	<b>Shore D</b>
5	Test Scale	(hardness testing of soft rubber, plastic and such substances)	(hardness testing of hard rubber, plastic and such substances)
6	Display	Bright & clear LCD display	Bright & clear LCD display
7	Result display	Hardness result, average value, max value (peak value lock), battery indication	Hardness result, average value, max value (peak value lock), battery indication
8	Data output	RS232	RS232
9	Measuring range	0~100HA	0~100HD
10	Tolerance	$\leq \pm 1HA$ (between 20~90HA)	$\leq \pm 1HD$ (between 20~90HD)
11	Display resolution	0.2 HA	0.2 HD
12	Statistics	Highest hardness, average	Highest hardness, average
13	Operating temperature	0 – 40 °C	0 – 40 °C
14	Features	Automatic switch off, battery low alarming	Automatic switch off, battery low alarming
15	Power Supply	3 x 1.5V-Buttonbatteries or 4.5V AC/DC adapter	3 x 1.5VButton batteries or 4.5V AC/DC adapter
16	Other features	Pocket size model with integrated probe	
17	Other Mandatory Items	While supplying the Machines, the supplier should also provide the following items apart from above:	
18		<ul style="list-style-type: none"> <li>• Hard copies of Operational &amp; Service Manual- 01 Set..</li> </ul>	
19		<ul style="list-style-type: none"> <li>• Machine should come with all other essential accessories, computer &amp; spares required for installation, commissioning&amp; Operation</li> </ul>	
20		<ul style="list-style-type: none"> <li>• Onsite Training to be provided for CIPET staff at commissioning site.</li> </ul>	

**2021-22/02/50 Spin coater**

S. no.	Item	Specification
1	<b>APPLICATION</b>	<ul style="list-style-type: none"> <li>It is used to coat the polymer &amp; nanomaterials on various substrates for different applications</li> </ul>
2	<b>Configuration :</b>	<ul style="list-style-type: none"> <li>The top plate assembly of spin coater with spin bowl/head</li> </ul>
3		<ul style="list-style-type: none"> <li>The spin coater should be clean room compatible</li> </ul>
4	<b>Spin Parameters</b>	<ul style="list-style-type: none"> <li>Spin Speed: 10 – 12000 RPM or better</li> </ul>
5		<ul style="list-style-type: none"> <li>Speed Accuracy: &lt; 1% or better error across the full scale</li> </ul>
6		<ul style="list-style-type: none"> <li>Acceleration/ Deceleration: 10 – 10000 RPM/sec or better</li> </ul>
7		<ul style="list-style-type: none"> <li>Time: 1-999 sec or more with increment of 1 sec or less</li> </ul>
8		<ul style="list-style-type: none"> <li>Spin speed stability : <math>\pm 1</math> RPM or better</li> </ul>
9		<ul style="list-style-type: none"> <li>Spin cycle: One cycle should have up to 16 steps with control of acceleration/deceleration.</li> </ul>
10	<b>Control parameters :</b>	<ul style="list-style-type: none"> <li>Spin parameters like spin speed / number of steps / acceleration / deceleration / step time.</li> </ul>
11	<b>Hot Plate</b>	<ul style="list-style-type: none"> <li>In built with the coating system and capable of varying substrate temperature from 40°C to 150°C or better</li> </ul>
12	<b>Substrate holder</b>	<ul style="list-style-type: none"> <li>Suitable vacuum chuck/holder to handle substrates of various size upto 4" wafer with integrated vacuum release switch for easy removal of substrates.</li> </ul>
13		<ul style="list-style-type: none"> <li>Suitable Fragment Adapter for (substrate size &gt; 3mm to 15 mm and &gt; 5 mm to 25 mm)</li> </ul>
14		<ul style="list-style-type: none"> <li>2 Nos each of substrate holder</li> </ul>
15	<b>Display</b>	<ul style="list-style-type: none"> <li>LCD touch screen with colour real time display of speed (RPM) versus time</li> </ul>
16	<b>Motor</b>	<ul style="list-style-type: none"> <li>Integrated brushless DC servomotor with closed loop digital speed control.</li> </ul>
17	<b>Gas purging connection</b>	<ul style="list-style-type: none"> <li>Nitrogen gas purging facility should be provided.</li> </ul>
18	<b>Vacuum pump</b>	<ul style="list-style-type: none"> <li>Oil free, Diaphragm pump with pumping speed ~ 75 lit/min</li> </ul>

19	<b>Safety interlocks</b>	<ul style="list-style-type: none"> <li>All the standard safety interlocks should be incorporated, including vacuum switch interlock.</li> </ul>
20	<b>Vacuum connections</b>	<ul style="list-style-type: none"> <li>Polyurethane tubing or equivalent for vacuum plumbing.</li> </ul>
21	<b>Power</b>	<ul style="list-style-type: none"> <li>230V AC <math>\pm</math> 10%, Single phase and 50 Hz.</li> </ul>

**2021-22/02/51 Tear Tester**

S. no.	Item	Specification
1	Applicable standard	<ul style="list-style-type: none"> <li>ASTM D1922 , ASTM D1424, ASTM D295, D752, D4247, BIS IS 13360-5-23, BIS IS 6489-1</li> </ul>
2	Pendulum Capacity	200,400,800,1600,3200,6400 gm
3	Pendulum Accuracy	0.5% of Pendulum Capacity
4	Calibration Weights	50%, 50%, 90%
5	Tearing Initial Angle	27.5 <sup>o</sup> $\pm$ 0.5 <sup>o</sup>
6	Measurement	Hi-resolution digital encoder
7	Accessories	Optional pendulum weight kit for heavier materials (128N),
8		Other necessary accessories
9	Features	<ul style="list-style-type: none"> <li>Clamp type should be both manual &amp; pneumatic</li> </ul>
10		<ul style="list-style-type: none"> <li>Clamp pressure in psi and kg/cm</li> </ul>
11		<ul style="list-style-type: none"> <li>Calculates force of multiple plies</li> </ul>
12		<ul style="list-style-type: none"> <li>Multiple data export options: USB flash drive, USB ESC/POS printer</li> </ul>
13		<ul style="list-style-type: none"> <li>Selectable units: grams-force, milli-newtons, lbs-force, percentage of pendulum capacity</li> </ul>
14		<ul style="list-style-type: none"> <li>PLC control and touch screen operation</li> </ul>
15		<ul style="list-style-type: none"> <li>Contact area and pressure are standards conformed.</li> </ul>
16		<ul style="list-style-type: none"> <li>Pendulum automatic release</li> </ul>
17		<ul style="list-style-type: none"> <li>Automatic calibration of pendulum</li> </ul>
18		<ul style="list-style-type: none"> <li>Automatic specimen notching</li> </ul>
19		<ul style="list-style-type: none"> <li>Automatic pendulum reset with lifting device</li> </ul>
20		<ul style="list-style-type: none"> <li>Tearing force displayed digitally</li> </ul>
21		<ul style="list-style-type: none"> <li>Safety hood protects operator from injury while pendulum is in motion</li> </ul>
22		<ul style="list-style-type: none"> <li>Hard copies of Operational &amp; Service Manual</li> </ul>

23	Mandatory Items	<ul style="list-style-type: none"> <li>• Calibration Certificate with traceable to NIST required parameters.</li> </ul>
24		<ul style="list-style-type: none"> <li>• Test Specimen punching tool</li> </ul>
25		<ul style="list-style-type: none"> <li>• Machine should come with all other essential accessories for commissioning &amp; Operation.</li> </ul>
26		<ul style="list-style-type: none"> <li>• Onsite training to be provided at commissioning site.</li> </ul>

### 2021-22/02/52 Thermal Evaporator System

S. no.	Item	Specification
1	<b>Application</b>	Thermal Evaporation system should be capable of depositing metals / metal oxides / ceramics with uniform film thickness
2	<b>Vacuum Chamber</b>	<ul style="list-style-type: none"> <li>• SS 304 Metal Chamber fabricated from polished stainless steel.</li> </ul>
3		<ul style="list-style-type: none"> <li>• Approximately 16" x 16" x 18" Height with front door opening.</li> </ul>
4		<ul style="list-style-type: none"> <li>• Cooling water pipeline is coiled on the outer wall of the chamber to prevent overheating, especially at the chamber windows and to reduce the out gassing by circulating the water and viewing window. There should be provision for necessary feed through.</li> </ul>
5		<b>High Vacuum Pumping System:</b>
6	<ul style="list-style-type: none"> <li>• Rotary pump (with appropriate oil/mist filter) for creating initial vacuum till <math>10^{-3}</math> mbar and backing for the turbo pump after that.</li> </ul>	
7	<b>Rotary Vacuum Pumping System</b>	(1 No) Capacity 250 LPM, Direct drive, Single phase, Double stage, Oil charge 0.75liters, Ultimate vacuum $> [5-6] \times 10^{-3}$ m. bar.
8		The pump should be capable for running 24 hrs.
9		nEXT400D ISO100 160W with inlet screen and manual vent valve Having Field replaceable bearing.01No.
10		01.Effective Pumping speed - $>300$ (LPS)

11	<b>Turbo Pumping System</b>	02. Ultimate vacuum - $10^{-7}$ (m. bar)
12		03. Critical backing pressure - $3.5 \times 10^{-1}$ m. bar.
13		04. No. of stages - 5.
14	<b>4" Butterfly valve</b>	(1No) a hand operated high vacuum valve is fixed to a base plate of 13" diameter. This valve isolates the chamber from the pumping system so that the chamber can be brought to atmospheric pressure without switching off the pumping system.
15	<b>1" Quarter swing Butterfly Valves</b>	(2 No's) one is for roughing and another for backing.
16	<b>A¼" air admittance valve</b>	(1 No) is fixed to the chamber pipeline to release the chamber vacuum after each coating process cycle.
17	<b>Needle valve</b>	[1No] along with the unit for gas purging. A fine control needle valves providing in the pipeline for use during H.T. discharge cleaning.
18	<b>L.T/H.T Control</b>	Variac (Dimmer) Controller in the input circuit of LT/HT selector provides the output power variation.
19	<b>Meters</b>	Separate digital panel meters provided for HT primary current LT secondary current through current transformers
20	<b>Indicator Lamps</b>	Glow lamps are to indicate ON/OFF status of rotary pump, Turbo pump, LT, HT and other accessories.
21	<b>Power connection</b>	For connection the power to the system 2 meters long 15amps wire chord with plug.
22	<b>Vacuum Measuring Gauges</b>	<b>Digital Pirani Gauge</b> -(1 No): Measure vacuum from 0.001 to 1000 m.bar anywhere in the vacuum system with suitable adaptor. Two gauge heads should be to this gauge to read fore vacuum and roughing vacuum of the system.

23		<b>Digital Penning Gauge- (1No):</b> Measure vacuum from $9.9 \times 10^{-3}$ to $1.0 \times 10^{-6}$ m.bar anywhere in vacuum system with suitable adaptor.
24	<b>LT Evaporation Feedthroughs</b>	Atleast 3 No. of LT electrical feed-through for evaporation, made of electrolytic pure copper with 200Amps current carrying capacity should be provided.
25	<b>Substrate Heater With Controller</b>	Maximum Temp: 500DegC
26		PID ON/Off Controller,
27		K-Type Thermocouple,
28		Heater Size: 3" Diameter,
29		Heating Element: Super kanthal,
30		Solid State relay and a Transformer.
31	<b>Substrate cooling facility</b>	To be provided through water piping (as main quotation).
32		Liquid nitrogen cooling facility can be provided as additional cost.
33	<b>Digital Thickness monitor</b>	<ul style="list-style-type: none"> <li>• Appropriate feed through and sensor to be provided close to the LT source.</li> </ul>
34		<ul style="list-style-type: none"> <li>• Ability to monitor evaporation rates of <math>0.1 \text{ \AA/s}</math></li> </ul>
35	<b>Quartz Crystal Thickness Monitor (DTM):</b>	<ul style="list-style-type: none"> <li>• 6 MHz crystal holder with oscillation box and connecting cables.</li> </ul>
36		<ul style="list-style-type: none"> <li>• Display:3digit LED.</li> </ul>
37		<ul style="list-style-type: none"> <li>• Thickness Display 4Digit LED auto ranging from 0.000 to 999.9 <math>\text{\AA}</math>,</li> </ul>
38		<ul style="list-style-type: none"> <li>• Crystal Frequency: 6MHz</li> </ul>
39		<ul style="list-style-type: none"> <li>• Thickness Set point 0.000 to 999.9K<math>\text{\AA}</math>,</li> </ul>
40		<ul style="list-style-type: none"> <li>• Film Dencity:0.800 to 99.99grams/cc.</li> </ul>
41	<b>Control Console</b>	Control console is fabricated with mild steel and neatly powder coated. It is provided to house all the electrical control instrumentation, control switches and standalone control panel of the following switches;
42		✓ ON/OFF switches for vacuum pumps and all valves
43		✓ vacuum measuring gauges controller
44		✓ Substrate rotation and substrate heater controls



45		The above control console is wired to operate on 230 V AC, 50Hz, Single phase power supply.
46	<b>Support structure</b>	<ul style="list-style-type: none"> <li>Should be made out of MS channel and angles, neatly painted</li> </ul>
47		<ul style="list-style-type: none"> <li>Must have castor wheels for mobility purpose.</li> </ul>
48	<b>Source shutter</b>	To cover the evaporation source
49	<b>Electrical Controls</b>	Unit operates on 220V A.C 50Hz single phase power supply.
50	<b>L.T Power Supply</b>	A 200Amps power supply capable of delivering (1 No)
51		a) 200Amps at 10Volts. And
52		b) 100amps at 20 volts intermittent.
53	<b>H.T Power Supply</b>	5000volts DC open circuit.
54		3500volts at 50mA high reactance type-1NO
55	<b>Safety Devices</b>	An electrical circuit breaker in different power supply line protects these against over-load shorting. An over load protection device for vacuum pump motor should be provided.
56	<b>Ultimate Vacuum</b>	The unit is specified to achieve an ultimate vacuum of $1 \times 10^{-6}$ m.bar in clean cool empty degassed condition within 1 hour of switching on of the pumping system.
57	<b>Purging</b>	Nitrogen and Air purging facility should be available
58	<b>Manual</b>	Operation Manual to be given after delivery and installation
59	<b>Inspection</b>	CIPET will inspect the instrument for two complete runs before despatch from factory outlet.
60	<b>Accessories</b>	<ul style="list-style-type: none"> <li>Basket: Spiral (10 each)</li> </ul>
61		<ul style="list-style-type: none"> <li>Boat: 10 each (Mo and W)</li> </ul>
62		<ul style="list-style-type: none"> <li>Evaporation materials:</li> </ul>
63		<ul style="list-style-type: none"> <li>Al metals (99.99%) 100 gm,</li> </ul>
64		<ul style="list-style-type: none"> <li>Ag metal (99.99%), 100 -gm</li> </ul>
65		<ul style="list-style-type: none"> <li>Au-wire (99.99%): 10 cm -</li> </ul>
66		<ul style="list-style-type: none"> <li>Ceramic boat (organic evaporation): 5 nos</li> </ul>
67		<ul style="list-style-type: none"> <li>Each 2 set of rubber O-rings for various sizes</li> </ul>
68		<ul style="list-style-type: none"> <li>Pump oil (2.5 lts)</li> </ul>
69		<ul style="list-style-type: none"> <li>Vacuum clamps with metal O-rings</li> </ul>
70		<ul style="list-style-type: none"> <li>Vacuum grease</li> </ul>
71	<ul style="list-style-type: none"> <li>Spare butterfly valves (1 No.)</li> </ul>	

72	• Pirani gauge (1 No.)
73	• Thickness monitor crystals (1-box)
74	• All required tools

**2021-22/02/53 Two Roll Mill**

S. no.	Item	Specification
1	Roll Diameter	Minimum 150 mm
2	Roll Width	Minimum 350 mm
3	Heating Power/Roll	2.5 kW- Electrical Heating
4	Roll Speed	Variable speed Drive 2-25 RPM
5	Nip-Gap	0.1-10 mm
6	Roll Temperature	Upto 300° C with an accuracy of $\pm 2^{\circ}\text{C}$
7	Accessories	Brass Spatula (2 Nos), Brass roll cleaning accessories,
8		Other necessary accessories
9	Features	• Uniform temperature distribution across rollers
10		• Rapid cooling of rollers by water circulation
11		• Any polymer like LDPE, HDPE, PP, PVC, PS, ABS, HIPS, Natural Rubber, EVA etc. can be tested
12		• Individual adjustable roller speed with digital RPM display
13		• Incorporated with additional safety features like Knee operated reversible emergency switch at both the sides, hand operated roller safety switch and emergency push button on panel
14		• Digital nip gap displays for both rollers
15		• Control options available like HMI touch screen with PLC control and digital display by PID controls
16		• Hard copies of Operational & Service Manual
17	Mandatory Items	• Machine should come with all other essential accessories & spares required for installation, commissioning & Operation.
18		• Onsite training to be provided at commissioning site.

**2021-22/02/54 UV-Vis-NIR Spectrophotometer**

S. no.	Item	Specification
1	Photometric system	Double beam optics
2	Monochromator	Double beam monochromator
3	Light Source	Deuterium lamp, WI lamp with automatic optical axis adjustment
4	Detectors	PMT, InGaAs and Cooled PbS: All three detectors
5	Wavelength Range	200 or lower to 3300 nm
6	Wavelength Accuracy	± 0.2 nm or lower for UV/Vis
7		NIR: ± 0.8 nm or lower
8	Resolution	0.1 nm or better.
9	Wavelength Repeatability	± 0.05 nm or better
10	Wavelength scanning speed	Instrument should have variable wavelength scan rate from 4000 to 0.5 nm/min (UV-Vis) and 9000 nm/min (NIR) with automatic selection.
11	Spectral band width	UV/VIS: 0.1 - 8 nm or higher
12		NIR: 0.2 - 32 nm or higher
13	Stray light:	0.00008 %T or less (220 nm, NaI)
14		0.00005 %T or less (340 nm, NaNO <sub>2</sub> )
15		0.0005 %T or less (1420 nm, H <sub>2</sub> O)
16		0.005 %T or less (2365 nm, CHCl <sub>3</sub> )
17	Photometric range	Absorbance = -6 to 6 Abs or better.
18		Transmittance & reflectance 0 to 80000% or better.
19	Photometric Accuracy	Instrument should have photometric accuracy
20		of ± 0.003 Abs (at 1 Abs), ± 0.002 Abs (at 0.5 Abs) or better/± 0.007 Abs (at 2 Abs) or better.
21	Photometric repeatability	0.0008 Abs (0 - 0.5A)
22		0.0016 Abs (0.5 - 1A)
23		or better.
24	Baseline Flatness	±0.001 Abs (200 - 3000 nm)
25		±0.005 Abs (3000 - 3300 nm)
26	Baseline stability:	Within 0.0002 Abs/h (500 nm, 1-second integration)
27	Noise Level	UV-Vis: 0.00005 Abs or less (500 nm)
28		NIR: 0.00008 Abs or less (900 nm)
29		0.00003 Abs or less (1500 nm)
30	Data Acquisition	The equipment should interface with computer and controlled by software. Data points in .csv format to be obtained.

31	<b>Accessories</b>
32	1. 10 mm rectangular quartz cell - 02 pair
33	2. 100 mm cylindrical quartz cell - 02 pair
34	3. Film Holder - 01 no.
35	4. Computer Interface: Latest configuration Branded PC
36	5. Printer Interface: laser jet Printer
37	6. The total instrument must have warranty of 36 months from the date of installation
38	<b>Optional accessories</b>
39	7. Integrating sphere accessory with facility to measure powder, film as well as liquid samples for diffuse as well as specular reflectance measurement, with wavelength range of 250 to 1400 nm or higher.

### **General terms and conditions :**

<ul style="list-style-type: none"> <li>▪ Tenders should specify and quote the necessary accessories required for installation and running the machine.</li> </ul>
<ul style="list-style-type: none"> <li>▪ Minimum 2 years compliancy warranty with additional 1 year's maintenance warranty must be provided in order to keep the equipment in continuous working condition.</li> </ul>
<ul style="list-style-type: none"> <li>▪ Onsite training as well as application support should be provided by the vendor at its own cost.</li> </ul>
<ul style="list-style-type: none"> <li>▪ Necessary spares and Consumable for 2 years</li> </ul>
<ul style="list-style-type: none"> <li>▪ Appropriate tool box/kit for routine maintenance should be provided with the equipment</li> </ul>
<ul style="list-style-type: none"> <li>▪ Technical support and service: Availability of technical support in the area of application and service both within the country, The Tenderer shall have local service and application office and infrastructure to attend by visit within 48 hours of need.</li> </ul>
<ul style="list-style-type: none"> <li>▪ In case of any up gradation of software within the period of warranty then the same should be provided free of cost by the supplier/manufacturer.</li> </ul>
<ul style="list-style-type: none"> <li>▪ All documents (i.e. manuals, drawings etc.) and original software's relevant to the instrument and its accessories must be supplied</li> </ul>