

Technical Specification For Tender No. 2021-22/04

2021-22/04/01 - 3D Printer

S.No	Technical Specification	
1	Model	Solid based production additive manufacturing system based on Material Extrusion technology, capable of producing parts for high temperature and strength application.
1.1	Technology	Should be able to build high strength, high performance and high temperature and medical grade materials. Provision for inclusion of new materials developed by R&D.
1.2	Machine Capability	200 mm x 170 mm x 150 mm (maximum allowable deviation 10%)
1.3	Minimum Build Volume (X, Y, Z)	Minimum horizontal build layer thickness 0.1 mm or better Greater/lesser than 0.1 mm can be quoted as additional features.
1.4	Layer Thickness	+/- 0.1 mm or better
1.5	Part accuracy (in all three directions)	Material handling systems should be part of the Printer with automatic material loading, feeding and storage management system. At any instance of the machine operation during idle or run time, the machine shall indicate the quantity of material available in the spool / cartridge for optimizing the material consumption.
1.6	Material Handling	Controlled Chamber temperature
1.7	Operation and Process	Material extruding nozzles should have self-cleaning mechanism
		Auto calibration of build platform for coordinates.
		Auto and manual calibration of offset between model and support nozzle.
		Printing status, Material in cartridge, Tip reading to indicate its life , Temperature of chamber and print head/nozzle etc..
1.8	Display Feature	Direct printing on base plate
1.9	Part building	Machine compatible of working in office/lab environments setup.
2	Facility Requirements	Noise level of the machine at the lowest level preferably 70 decibels. Relevant documentation/test results to be provided.
3	MATERIAL	Suitable Materials for medical, aerospace and other high performance engineering application.PEEK, Medical grade PEEK, CFR PEEK, PEI and metals. Medical grade material should be biocompatibility and sterilisation properties and Confirming ISO 10993 or equivalent standard.
4	Model Material	
4.1	SOFTWARE	Software should capable to edit the internal structure of each layer and/or group of layers of the CAD model.

4.2	Slicing and control	Software should generate customizable build styles & Auto Orientation
		Software should provide real time part build status, time etc.
		Software should have capability to section large parts which does not fit into the build volume
		Software should be able to create stabilizing structures to support build of thin and tall geometries. And ability to put supporting structures to prevent warpage in case of large flat and bulky parts.
		Software allow the user to add various jobs to a queue for sequencing and job management
		Software should have ability to pre-program pauses on any layer of the generated slice file to add metal inserts, change color of filament.
		Software and its support/updates/upgrades should be from OEM/manufacturer of the offered machine.
		License must be perpetual
4.3	License	10/100 base T connection. Ethernet protocol
4.5	Networks Connectivity	Compatible with latest Windows OS
4.6	Workstation Compatibility	Machine should be Regulatory Compliance - CE / FCC Relevant documentation to be attached.
4.7	Regulatory Compliance	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. Operations of machine should be in closed chamber with necessary safety measures. Chamber door must auto lock during part building.
4.8	Safety	
5	Essential Accessories	Bidder should specify and quote as per the requirement
5.1	Support removing system	Bidder should supply minimum quantities of consumables like build platforms, wiper blade, brush etc., required for 6 months. Also bidder should supply minimum quantity of model material each type 10 Canisters and support material each type 05 Canisters. Minimum two sets of Nozzles for different layer thickness minimum to maximum for all types of materials.
5.2	Consumables	Bidder should supply suitable compressor with dryer and filter units along with the machine, the compressor should have an air storage capacity that support the machine and its accessories for at least 1 hr at the time of power failure.

5.3	Compressor	Vendor should supply suitable de-humidifier to maintain room humidity level within suitable range for machine operation.
5.4	De-humidifier	Bidder to specify and quote suitable system for drying the filament
5.5	Filament Dryer	Bidder to specify and quote suitable system for printing of metal parts
5.6	Sintering & De-binding station	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.
5.7	Online UPS	Bidder should supply suitable latest model OEM workstation with complete accessories and UPS for handling large size stl data (128 GB RAM, i7 or higher processor, Hard disk 5TB, 4GB dedicated Graphics card)
5.8	Workstation with accessories	Bidder should supply standard tool kit for startup, removal of parts and cleaning (list to be attached).
5.9	Tool kit	Bidder should quote and supply any other accessories for high speed printing, material transport trolleys / carts and spares required for effective and better utilization of machine.
6	Any other accessories required	Bidder should submit complete scope of supply (Machine, standard accessories, Optional Accessories etc with make model) in the technical bid without price. Bidder should supply complete start up package including material necessary to prove the machine and provide training.
7	Scope of supply	The bidder must have supplied machines at other Institutes in the past (a satisfactory performance certificate from those users may be solicited if needed). Bidder should submit complete contact details.
8	Terms & Conditions	Manufacturer of the supplied equipment must be ISO Certified
		Authorization Letter from OEM
		List of clients in last five years to be provided.
		Manufacture/Supplier should have sizable installations of same model worldwide and at least Fives in India.
9	INSTALLATION, COMMISSIONING AND TRAINING	Bidder should state the space required and condition of floor and any other requirements for installation of the machine and equipments. State clearly the specifications of electrical requirement. Vendor should carry out installation and commissioning of the machine and its accessories on a turnkey basis.

9.1	Installation and commissioning requirements	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.
9.2	Training and documentation	<p>The vendor should supply the necessary manuals such as</p> <ul style="list-style-type: none"> · Software instruction · Maintenance and trouble manual · Training · Installation and Commissioning · Handling of accessories · Software key (if any) · Software CDs
9.3	Technical support and service	<p>Manufacturer should have established after sales & service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 48 hours of need. Technical support personnel must have adequate experience in this field. Technical support personnel details should be submitted. Name and address of the authorized service centre/ partner in India along with the certificate of authorization should be attached.</p>

2021-22/04/02 - ARC RESISTANCE		
S. No.	Technical 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
		Voltage and current calibration facility should be available.
4	Input Supply Voltage	230 V \pm 10%.
5	Voltameter	0-15kV
6	MilliAmmeter	10-40 mA \pm 5%.
7	Timer	0 – 999 seconds with an accuracy of 1 second
8	Wiring	All wiring in the arc circuit must be of ignition wire rated at 15kV and higher
9	Electrodes	Stainless steel strip: 25.4 mm x 12.7 mm x 0.15 mm
		Tungsten rod: 2.4 mm dia and 45 mm long
10	Specimen platform	Graphite
11	Specimen size	0-30 mm
12	Enclosure	Test chamber with door interlock system to protect user from direct contact of high voltage with control for user safety
13	Other Features	Dedicated PLC system for control of sequence and user friendly.
		Automated test controller
		LCD Display to set test parameters and read test results.
		Exhaust fans in – built in the test chamber to remove fumes
		Adjustable test jig to hold different test samples of various dimensions
14	Mandatory Items	· Hard copies of Operational & Service Manual
		· Grinding and polishing block for electrode
		· Calibration Certificate with NIST traceability should be provided.
		· Machine should come with all other essential accessories, spares including additional one pair of electrodes required for installation, commissioning & Operation.
		· Onsite training to be provided at commissioning site.

2021-22/04/03 - Automatic Compression Moulding Machine		
S. No.	Technical Specification	
1	TYPES OF TESTS TO BE PERFORMED	Molding of polymeric material under compression press as per the desired size to undertake specimen preparation for various mechanical properties study.
2	APPLICABLE STANDARD	ASTM D4703(Method A, B, C & D) ISO 293
TECHNICAL SPECIFICATION FOR HYDRAULIC COMPRESSION MOLDING MACHINE		
3	Clamping force	30 ton (adjustable). · Min300mm x min300mm polished platens for heating/cooling Capable of making compression molded plaques
4	Operating mode	Manual & Automatic both
5	Max. Daylight	350 mm or equivalent
6	No. of daylight	1
7	Max. mould height	350 mm or equivalent
8	Hydraulic cylinder stroke	150 mm or better
9	Ejector force	Manual
10	Ejector stroke	Manual
11	Electrical motor	To be clearly specified by the vendor
12	Mode of operation	Operating buttons, including two-hand anti-tie down-circuit
13	Construction type	4 post/column
14	Electrical heating of platens	400°C or better · Uniform temperature distribution on platen surface. · Programmable digital controller ..
15	Hydraulic System	Self-contained,energy efficient hydraulic system with access panel and gauge for Oil level and temperature indication should be provided. It should have dual pump system and water cooled heat exchanger.
16	Control System	· Operating buttons, including two hand “anti-tie-down” circuit for cycle initiation. · Proximately switches to control “slow close” position and “cycle reset”. · Clamp pressure relief valve and gauge. · Touch screen control panel · PID temperature controllers. · Timer up to 999 minutes. · Alarm display manual / auto cycle. · Emergency down and stop switches
17	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.

18	Safety features	· Safety guards to be provided with the molding area with manual sliding, interlocked operator gate
19		· Automatically switching from heating to cooling mode.
20		· The system should have automatic low pressure system
21		· Thermocouples for insertion into drilled backing plates.
22		· Facility for controlling the system with Auto & manual both.
23	Calibration certificates	· Calibration of platen temperature control & pressure calibration to be provided.
24	The machine should be supplied with suitable compression Moulds as per below specification, material feeding-manually, compression release, ejection, curing time one cycle auto.	
25	Spares Parts	Hydraulic Oil -As per requirements for Installation & operation of Machine .
		Electrical spares of reputed brand –Catridge Heaters-01 set, temperature sensor-01 set,solenoid valve-01 ,MCB -01no
26	Other Mandatory Items	While supplying the Machines, the supplier should also provide the following items apart from above:
		· Hard copies of Operational & Service Manual-01 Set .
		· Calibration Certificate for Temperature and parallelisim for the plattens with Traceability.
		· Hydraulic as per the requirements.
		· Machine should come with all other essential accessories & spares required for installation, commissioning& Operation.
COMPRESSION MOULDS		
27	Mould material	Stainless Steelor as mentioned in ASTM4703
28	Tile Mould	200x200mm thickness 3.2 mm
		150mm x 150 mm each for 0.5 mm, 1.0mm, 1.5 mm, 2.0mm, and 4.0mm thickness sizes.

29	Circular mould	Male female type mould with opening tool. For preparing sheet of 120 mm diameter and 10 mm thickness as per ISO 16770
30	Specimen moulds	Cavities with specimen dimensions complying ASTM above standards to be provided
31	Mandatory Items	While supplying the Machine, the supplier should also provide the following items apart from above:
		· Hard copies of Operational & Service Manual-01 set
		· Basic Tool Kit box with all necessary Tools like spanner, allenkeys, scew driver set, etc ,
		· Safety gloves & goggles required for day to day activities during operation of Machine.
		· Machine should come with all other essential accessories & spares required for installation, commissioning & Operation including Hydraulic Oil .
<u>General terms and conditions :</u>		
§ Tenders should specify and quote the necessary accessories required for installation and running the machine.		
§ 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.		
§ Onsite training as well as application support should be provided by the vendor at its own cost.		
§ Necessary spares and Consumable for 2 years		
§ Appropriate tool box/kit for routine maintenance should be provided with the equipment		
§ 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.		
§ 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.		
§ All documents (i.e. manuals, drawings etc.) and original software's relevant to the instrument and its accessories must be supplied		

2021-22/04/04 - Automatic Viscosity Measurement System		
S. No	Technical Specification	
1	Applications	To measure the viscosity of polymer solution by measuring the time taken for a defined quantity of fluid to flow through a capillary with a known diameter and known length using Ubbelohde viscometers, for polymer solution, pharmaceutical etc.
2	ASTM Standard	To be specified
3	Module	PC controlled Automatic Viscosity Measuring system with ubbelohde capillary viscometers for series dilution measurements with a waste system.
		Pressure and suction mode operation for the same system
		In-built Software
		Solvent bottles with holders, tubes and other accessories-02 nos. or better : As per actual requirement
		Connections: Pneumatic connections, Electrical connections, Mains connections, and Pump connection should be standard
		A suitable branded PC & Software controlled system with printer
4	Operation Control	Operation through software via. PC software to be included
5	Measuring range (time)	Up to 9,999.99 s; Resolution: 0.01 s
6	Measuring range (viscosity)	Pressure: 0.3 to 1,200 mm ² /s or better; Suction: 0.35 to ~5,000 mm ² /s
7	Ubbelohde for dilution viscometry not calibrated, for automatic measurements	Total range 0.35 mm ² /s to 60 mm ² /s
		Capillary tube with Constant K values- Values to be specified
8	Other essential requirements	Pump pressure: automatically controlled
		Pneumatic connections threaded connections for viscometers
		Data Input/Output-To be specified
		Housing Material: To be specified
		Measured parameter flow through time [s] Accuracy of the time measurement $\pm 0.01\%$ Measured value display via PC Display accuracy ± 1 digit (0.1%) Pump pressure automatically controlled CRM materials should be supplied with the machine All the accessories and spare parts should be supplied for smooth running of the instrument Bidder to specify and quote any other accessories required for better utilization of the equipment
9	Bath	Constant temperature water bath to meet the requirements as per IS 4669

2021-22/04/05 - Capstan Lathe Machine		
S. No	Technical Specification	
1	Spindle hollow - mm	38 - 40
2	Collet capacity - mm	30-32
3	Range of speeds - RPM	80 – 1500
4	Effective stroke of capstan slide - mm	130 – 150
5	Bore size in hexagonal turret - mm	25 –30
6	Feed rates of turret - mm	0.05 –2 (Auto)
7	Center of holes above turret slide - mm	45 – 55
8	Maximum difference between spindle nose to turret face - mm	400-450
9	Cross slide traverse - mm	90-100
10	Cross slide longitudinal travel - mm	300-350
11	Length of bed - mm	1200 -1400
12	Width of bed - mm	175-200
13	Height of center above bed - mm	150 - 175
14	Head stock	All geared and running parts of head stocks should be heat treated and ground
15	Cross slide	• Should have both hand and auto longitudinal
		• Threading range 4 to 60 TPI
		• Feed to be provided through gear box
		• Self shaft for fine and rough turning
		• Longitudinal stop to be provided
16	Accessories	
16.1	Ø160 mm x 3jaw self center chuck	Set of accessories suitable to the machine
16.2	Four Jaw chuck (ø 160 mm) with Adapter	
16.3	MT5 – MT3 center sleeve	
16.4	MT3 – male center	
16.5	Quick change tool post	
16.6	Electric coolant system with splash guard	
16.7	4 way Tool post	
16.8	5c Quick acting collet attachment	
16.9	Hand wheel type collet attachment	
16.10	Set of collets -size 5 mm to 20 mm step of 1 mm	
16.11	Collet Holders	
16.12	Dog carriers dia. 20 mm , dia. 30 mm	
16.13	Splash Guards	
16.14	Revolving Center	
16.15	Drill Chuck	
16.16	Reduction sleeve- MT3-MT2, MT2-MT1	
16.17	Fixed & Traveling steady rest	

16.18	Extra change gears –for inches,module&DP threads	
16.19	Face plate(200mm)	
16.20	Driver plate	
16.21	Service tools	
16.22	Machine Lamp	
16.23	Live & Dead Center	
16.24	Foot Brake	
16.25	Chuck guard	
16.26	Tools kit	
16.27	One set of manuals	
16.28	Coolant Pump (0.25 - 0.5 HP)	
16.29	Anti vibration pads	
17	Any Others Aecessories	Bidder to specify and quote if any other accessories available /required for smooth running of the machine.
18	Terms & Conditions	<p>Manufacture/Supplier should have sizable installations of same or better model worldwide and at least Five in India which is education institutions centrally funded institution. A Satisfactory Performance certificate from two institutions to be provided for eligibility. Bidder should submit complete contact details</p> <p>Equipment should be CE certified</p> <p>Authorization Letter from OEM</p> <p>List of clients in last five years to be provided.</p>

19	Scope of supply	Bidder should submit complete scope of supply (Machine, standard accessories, Optional Accessories etc with make model) in the technical bid without price. Bidder should supply complete start up package necessary to prove the machine and provide training.
20	INSTALLATION, COMMISSIONING AND TRAINING	
20.1	Installation and commissioning requirements	Bidder should state the space required and condition of floor and any other requirements for installation of the machine and equipments. State clearly the specifications of electrical requirement. Vendor should carry out installation and commissioning of the machine and its accessories on a turnkey basis.
20.2	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
		· Software instruction
		· Maintenance and trouble manual
		· Training
		· Installation and Commissioning
		· Handling of accessories
· Software key (if any)		
· Software CDs		
20.3	Warranty	The whole system and its accessories should be given two years warranty for the machine and three years for the spindle replacement and service against any design, manufacturing and workmanship defects from the date of installation and commissioning.
20.4	Technical support and service	Manufacturer should have established after sales & service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 48 hours of need. Technical support personnel must have adequate experience in this field. Technical support personnel details should be submitted. Name and address of the authorized service centre/ partner in India along with the certificate of authorization should be attached.
20.5	Annual Comprehensive Maintenance Contract (ACMC) as optional	Vendor should quote for Annual Comprehensive Maintenance Contract for the whole system and accessories supplied after the completion of performance warranty period. Supplier has to provide service support within 48 hours. Calibration of the machine shall be a part of warranty and ACMC. It shall also be mandatory to perform calibration after every major repair or breakdown

2021-22/04/06 - Computerised Universal Testing Machine Model 600 KN		
S. No.	Technical Specification	
1	Application	To be designed for testing of ferrous and no ferrous materials under Tension, flexural and compression bending
2	Maximum Capacity	600 KN
3	Measuring Range	0-600 KN
4	Load Resolution (20,000 counts full scale)	Up to 50 N
5	Resolution of Piston Movement	0.1mm
6	Clearance For Tensile at fully descended working Piston	50-800 mm
7	Clearance for compression test at fully descended working Piston	0-800 mm
8	Clearance between columns	Should be more than 600 mm
9	Ram Stroke	250 mm or equivalent
10	Straining / Piston speed (at no Load)	0-100 mm/min.
11	Load capacity	400 KN,600 KN
12	Dimension	L x W x H (Approx.): - 2420 x 820 x 2900 mm
13	Standard Accessories	
14	1) TENSILE TEST FOR ROUND SPECIMEN :- Clamping Jaws for round Specimen of diameters :-	10-25, 25-45, 45-70 mm
15	2) TENSILE TEST FOR FLAT SPECIMEN :- Clamping Jaws for Flat specimen of thickness :-	0-22, 22-44, 44-65mm, width Max. 70mm
16	3) COMPRESSION TEST:	
17	Pair of compression plates of diameters	160mm.
18	4) TRANSVERSE TEST:	
19	Table with adjustable rollers of width	160 mm,
20	Table with adjustable rollers of width	160 mm,
21	Diameter of rollers	50 mm,
22	Maximum clearance between supports	800 mm,
23	Radius of punch Tops	16 and 22 mm.
24	Flexural Test	3 point Bend fixture with span continuously variable from 10mm to 300mm or more and roller sizes of radius from 6 mm to 76 mm.
25	Other Requirements	Loading accuracy as high as $\pm 1\%$ Straining at variable speed Printer & PC graphs enable study the behaviour of the material. Motor driven threaded columns for quick effortless adjustment of lower cross-head-to facilitate rapid fixing of test specimen. Digital display.

		RS 232 serial port to transfer data to computer for analysis/storage evaluation etc.
26	Strain Unit	<ul style="list-style-type: none"> · Rotary encoder of minimum resolution 0.1 mm · Tension test to be conducted by fixing test specimen between upper and lower cross head · Compression, bending, transverse and shear test to be conducted between lower cross head and table · Provision for rapid change the position of lower cross head by operating screwed column for easy fixing of specimen
27	Hydraulic control system	<ul style="list-style-type: none"> · Power pack based pressure maximum 200 Kgf/cm² · Should maintain continuous non pulsating oil flow for maintaining very smooth load application · To maintain practically constant rate of piston movement · Operation through pressure transducer · Both load and displacement to be displayed on the digital readout simultaneously
28	Extensometer	
29	Measuring range	Up to break
30	Least count	0.01 mm
31	Arm travel	800 mm
32	Thickness or diameter of specimen	1 to 20 mm
33	Calibration	Extensometers shall be calibrated, certified as per ASTM standards.
34	Data Acquisition & Software	<ul style="list-style-type: none"> · Real-time image, stress-strain curve, load deformation, load-time curve, load/strain, Young Modules etc. shall be displayed by the software. · The upper and lower yield, maximum breaking and strain, breaking/elongation ratio of selecting point etc. required be supplied from graphic. · Software shall record and generate test report. The software shall have wide range of process. Test results can be displayed in Metric and System International (SI) system. · Automatic zeroing at the beginning of the test and auto return facility after specimen failure is required · All test results to be displayed on the screen. System should have option for automatic break detection · Software should compatible with extensometer

		· Data analysis, statistics, point tracing, superimposing graph for comparison should be available
35	Accessories	The manufacturer shall recommend along with the price, list of the spare parts sufficient for a period of two years trouble-free operation of complete system. Computer system & Printer to be provided.
36	Installation, Commissioning & Performance guarantee	· The Supplier shall be responsible for carrying out the Installation and Commissioning at customer site.
		· Shall provide guarantee for the satisfactory performance of the system for a period of two year after satisfactory installation and commissioning at Purchaser's site.
		· Complete training should be provided at the site.
37	Technical support and service	Manufacturer should have established after sales & service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 48 hours of need.

2021-22/04/07 - Computerized Universal Testing Machine (100 KN) with Electronic Extensometer and all Accessories		
S. No	Technical Specification	
1	Control System	Microprocessor controlled
2	Maximum Load Capacity	100 KN
2	Cross head Travel distance	Min 1000 mm
3	Horizontal daylight	Min. 450mm
	Cross Head Speed	
4	Minimum	0.001 mm / min
5	Maximum cross head speed at 50 KN	Should be more than 500 mm/min
6	Accuracy for Cross head speed	± 0.1 mm/min
7	Load cells	100 N, 1 kN, 50 KN
8	Load cell Accuracy	+/- 0.5% of reading down to 1/50 of full scale with ASTM E83 class B extensometers should meets or exceeds
		Pneumatic and Screw type
		Specimen Thickness-200 microns to 10 mm
		Specimen length: 2 cm to 20 cm
		Specimen width: Up to 2 cm
		Provision of special gripping for polymeric, film and rubbery materials, Wide variety of grips and fixtures
		Pneumatic grip 25 x 50 mm up to 10 KN
		Pneumatic grips for fiber

9	Grips & Fixtures	<p>Rigid plastics (self lock wrench grip, opening up to 12mm), plastic/composite rod (upto 12 mm dia) woven sacks (100 mm width), rubber, fibre/filament.</p> <p>Compression test kit</p> <p>Fixtures for peel and shear</p> <p>Flexural - three point bend jig fixture with different nose dia for specimen support up to 10 KN and adjustable span 10-400 mm</p> <p>All fixtures should be suitable for low temperature testing and can be accommodated in to environmental chamber</p>
10	Test Conform to	<p>Tensile: ASTM D 638, ASTM D 882, and ISO 527</p> <p>Flexural: ASTM D 790 and ISO - 178</p> <p>Compression: ASTM D 695</p> <p>Shear: ASTM D 732</p>
11	Extensometer	<ul style="list-style-type: none"> · Automatic axial contacting extensometer · Should have capability for automatic gauge length positioning and automatic attachment to the specimen · Should be fully controlled by system software · Gauge length:10-700 mm · Vertical travel: 750 mm · Specimen width:0-400 mm · Specimen thickness:0-100 mm · Specimen diameter:0-100 mm · Resolution: 0.1 μm · Accuracy: 0.5% of reading · Machine shall be able to measure extension 0.01mm with extensometer
12	Data Acquisition Rate:	24-bit resolution card with data acquisition rate of minimum 500 Hz simultaneously on load, extension, and strain channels.
13	Data Sampling Rate:	400kHz or better
14	Safety lock provisions	Limiting switch for cross head travel should be provided.
		<p>a. Configure a specific transducer (such as load cell or extensometer) and link it with a specific method</p> <p>b. Software should have the capability to perform tear, adhesion, peel, cyclic tests in addition to tensile, flexural and compression tests</p> <p>c. Window's based graphical user interface.</p> <p>d. User calculation creator for defining custom calculations.</p> <p>e. Automatic grip control (frame dependent).</p> <p>f. Saving and retrieval of test methods and data. Advanced data management and high-speed data retrieval system for accessing history. Option to edit/change/modify history.</p>

15	Software	g. Software should automate data acquisition, machine control, analysis, and reporting for a wide range of test requirements.
		h. The standard templates should include but not limited to monotonic loads, tests with varying rates of loads including linear, sine, cyclic, ramp, etc.
		i. The software should have the capability to save the test method along with the start position, limit positions etc. so that the machine automatically comes to the start position for testing when the file is opened.
		j. The software shall allow exporting the raw data into excel or word etc.
		k. Software must support data acquisition modes according to time, peak/valley, cyclic/ logarithmic.
		l. Machine must be able to measure & record following parameters, in SI units
		Ultimate Tensile Load (kN, N, kg)
		Breaking Load
		Yield Load
		Cross sectional area (mm ² , cm ² , m ²)
		Ultimate Tensile Strength (MPa, N/cm ² , N/m ²)
		Yield Stress
		Proof Stress
		Gauge Length (mm, cm, m)
		Elongation at specified load (%)
		Load at specified elongation or travel length
		Elongation (%)
		Modulus of Elasticity
		Must be able to plot/display real time online illustrative graph on display screen for :
		i. Load Vs Displacement
ii. Load Vs Elongation		
iii. Stress Vs Strain		
iv. Stress Vs Elongation		
Software must be able to automatically calculate & report		
16	Essential Accessories	I. All necessary fixtures/adaptors/accessories shall be supplied to set up and perform the flexure test using the UTM.
		II. To be provided along with 10KVA UPS for equipment
17	Computer System	Computer with suitable configuration to support the software and colour bottled printers should be provided.
18	Environmental Chamber	Environmental Conditioning Chamber temp. range - 100° C to 150° C
19	Any other accessories required	Bidder should quote and supply any other accessories effective and better utilization of machine.
20	Calibration certificate	Calibration certificate for load cells and extensometer traceable to National / International Standards should be Provided

21	Scope of supply	Bidder should submit complete scope of supply (Machine, standard accessories, Optional Accessories etc with make model) in the technical bid with price. Bidder should supply complete start up package including material necessary to prove the machine and provide training.
22	Terms & Conditions	The bidder must have supplied machines at other Institutes in the past (a satisfactory performance certificate from those users may be solicited if needed). Bidder should submit complete contact details. Authorization Letter from OEM List of clients in last five years to be provided. Manufacture/Supplier should have sizable installations of same model worldwide and at least five in India.
23	INSTALLATION, COMMISSIONING AND TRAINING	
24	Installation, Commissioning & Performance guarantee	<ul style="list-style-type: none"> · The Supplier shall be responsible for carrying out the Installation and Commissioning at customer site. · Shall provide guarantee for the satisfactory performance of the system for a period of TWO years after satisfactory installation and commissioning at Purchaser's site. · Complete training should be provided at the site.
25	Technical support and service	Manufacturer should have established after sales & service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 48 hours of need.

2021-22/04/08 - Electrodynamic Shaker		
S. No.	Technical Specification	
1	Scope of supply	<ul style="list-style-type: none"> · Electrodynamic vibration shaker with base table · Power amplifier · Shaker cooling systems and other auxiliaries
2	General Specifications for shaker	<ul style="list-style-type: none"> · Acceleration: <ul style="list-style-type: none"> ü Bare table - 110 g pk ü 1 lb load - 55 g pk ü 5 lb load - 18 g pk · Stroke size: 1 Inch · Velocity (Max.): 70 ipspk · Sine Force: 110 lbs force pk · Random Force: 75 lbfrms random · Shock Force: 225 lbfpk · shock Frequency Range: DC to 6,500 Hz · Max. Acceleration: 110 g pk, · Maximum acceleration ü Resonant 150 g pk

		<ul style="list-style-type: none"> ü Peak shock 200 g pk · Max. Displacement: ü Continuous pk-pk - 1.0 inch ü Between stops - 1.03 in · Cooling: Amplifier: forced air · Shaker: cooling blower
3	General Specifications for Linear Power Amplifier:	<ul style="list-style-type: none"> · Output voltage: 50 V rms · Output current: 20 A rms · Max. cont. dissipation 900 W · Frequency response ü DC input: DC to 10 KHz -.6 dB ü AC input: 1.0 to 10 KHz -.6 dB · Max. voltage gain: 36 dB · Cooling 2-speed fan, automatic · Input impedance: 10 kΩ ü Volts, pk 19 segment ± 5 % ü Amps, rms 19 segment ± 5 % · Interlock circuit External: F.O. switch or TTL Shaker · Optional field power: 1000 W max · Interlock protection: · Over current ü Supply over voltage ü Power module failure ü Amplifier cooling ü Vibrator cooling ü Power module over current ü Phase failure
4	Specification for Vacuum Cooling system	<ul style="list-style-type: none"> · Blower type: Regenerative Ring Vacuum · Flow @ pressure: 30 cfm @ 30" H2O min · Motor: 0.75 Hp · Intake: 0.63" & 0.75" dia. (shaker fittings included) · Hose length: 7.5', flexible vacuum · Minimum vacuum life: >25,000 Hrs · Noise Level: < 71 dB @ 1M
5	Power	<ul style="list-style-type: none"> · 230V AC ± 10%, Single phase and 50 Hz.
<u>General terms and conditions :</u>		
§ Tenders should specify and quote the necessary accessories required for installation and running the machine.		
§ Minimum 2 years compliancy warranty with additional 1 year's maintenance warranty must be		
§ Onsite training as well as application support should be provided by the vendor at its own cost.		
§ Necessary spares and Consumable for 2 years		
§ Appropriate tool box/kit for routine maintenance should be provided with the equipment		
§ 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.		
§ 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.		

§ All documents (i.e. manuals, drawings etc.) and original software's relevant to the instrument and its accessories must be supplied

2021-22/04/09 - ELMENDORF TEAR TESTER		
S. No	Technical Specification	
1	Applicable standard	· ASTM D1922, ASTM D1424, ASTM D295, D752, D424
2	Pendulum Capacity	200400800160032000000
3	Accuracy of the mean force measurement	±1% of the indicated value
4	Gas Source	0.6 MPa(87 psi)
5	Tearing Initial Angle	27.5 ° ±0.5°
6	Measurement	Hi-resolution digital encoder
7	Accessories	<ul style="list-style-type: none"> · Computer-assisted calibration software + set of weights and accessories · Specimen preparation/cutting tools/Standard punch as per standard · Standard Pneumatic grips · Compressed air system for pneumatic Gripping · Other Standard operating tools and accessories as per standard.
8	Features	<ul style="list-style-type: none"> · Clamp pressure in psi and kg/cm · Calculates force of multiple plies · Multiple data export options: USB flash drive, USB ESC/POS printer · Selectable units: grams-force, milli-newtons, lbs-force, percentage of pendulum capacity · PLC control and touch screen operation. · PC with operating software & Printer · Contact area and pressure are standards conformed. · Pneumatic specimen clamping and pendulum automatic release · Automatic calibration of pendulum · Automatic pendulum reset with lifting device · Tearing force displayed digitally · Safety hood protects operator from injury while pendulum is in motion
9	Mandatory Items	<ul style="list-style-type: none"> · Hard copies of Operational & Service Manual · All necessary CRM along with the calibration certificates wherever required traceable to international standard should be provided. · Machine should come with all other essential accessories, computer & spares required for installation, commissioning & Operation.

	· Onsite training to be provided at commissioning site.
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2021-22/04/10 - Environmental Test Chamber		
S. No	Technical Specification	
1	Maximum dimensions of the module to be accommodated inside the chamber - mm	2500 x 2000 x 50 or equivalent
2	Minimum Internal clear area dimensions of the chamber - mm	2800 x 2300 x 1500 or equivalent
3	Temperature measurement	Online measurement of temperature and continuity of the modules during test
4	Accuracy - °C, %	<ul style="list-style-type: none"> • Temperature accuracy $\pm 1^{\circ}\text{C}$ humidity chamber should be $\pm 2\%$ RH respectively. • A durable and rugged temperature & humidity sensor should be integrated with the unit.
5	Other Features	<p>It will be desirable to have a low height of “chamber-floor” from the ground level (of the test laboratory) say 200 mm to 450 mm to facilitate ease of loading / unloading or making connection of the probe lead to the PV module by the operator. In that case the compressors & other fittings may be at the back side of the chamber, (slightly separated from the main chamber). The chamber should operate on A.C electrical utility of 415 Volt $\pm 15\%$, 3 Phase (Star connection) 50 Hz. or 230 Volt $\pm 5\%$, 50 Hz. In case of 3 phase the electrical load of the chamber should be equally distributed on all the 3 phases during all modes of operation.(cooling /heating, idle running or full load running of the compressors).</p>

6	The module Holder/Rack - mm	<ol style="list-style-type: none"> 1. Holder for mounting of the SPV modules should be able to accommodate Min 10 modules of maximum size up to 2500mm x 2000mm x 50mm or equivalent at a time. 2. It should be capable to hold them vertically with a spacing of 200 mm (min) between each module. The design should be such that there should be proper ventilation for each module so that the homogeneity of temperature and humidity is maintained. 3. Rack should be able to support max 10 modules held vertically upright position. 4. The rack may be design in such a way to guide the base of the module at the bottom and camp it from top. 5. The material shall be so chosen that the module remain, dielectrically insulated from each other as also from Environmental chamber body. It should be able to withstand up to 100°C and 90 % RH.
7. Details of Test Chamber		
a	Material	stainless steel grade suitable for the requirement, and provide the protection from corrosion
b	Dimensions - mm	Equivalent External dimensions of the chamber will be as per the manufacturer design however the information on external dimensions and required clearance are to be supplied by the manufacturer/supplier at the time of quotation
c	Weight	Max. Weight of one test PV module: 40 kg (approx. 65 % glass), floor of the chamber should be capable to withstand the load. Load withstand capability should be mention in the quotation
d	Exterior Material	Double coated galvanized steel sheet suitable for corrosion resistance in tropical climates. The exterior finish should be Single or two-coloured, powder coated (Manufacturer/Supplier to indicate)
e	Door	Preferred hinged on left, with latching arrangement along with excellent seal to stop thermal or conditioned air leakage. The hinge should be capable to withstand the 50,000 operations without fail.
8. Equipment		
a	Viewing window	The front door should have viewing window (of reasonable size) with wiper/suitable arrangement so as to facilitate visual check on specimen and sensor leads during the test.

b	Refrigeration unit	<input type="checkbox"/> Water cooled refrigeration system to ensure long and continuous operation say up to 100 days at a single stretch. <input type="checkbox"/> The compressor shall be mounted on anti-vibration pads
c	Heating System	<input type="checkbox"/> Stainless Steel sheathed air heaters to achieve the desired set temperature. <input type="checkbox"/> The heaters shall be placed in the conditioning plenum such that there is no direct radiation from the heaters onto the test specimen. <input type="checkbox"/> Heater outputs shall be controlled for superior stability and control in temperature.
d	Control	Digital Measuring and control system and a PC through RS-232 /USB connection.
e	Interface	Serial interface RS 232/USB for connection to PC for bi directional communication
f	High/Low temperature safety device	Pl. specify as per relevant European Standard)
g	Air flow	The air circulation within the chamber shall be as close to laminar ensuring uniform airflow across the whole workspace
h	Interior Illumination	Interior illumination with lamp and the switch to be located outside.
i	Humidification system	Preferred with steam humidifier
9. Chamber Performance		
a	Maximum temperature - °C	+120 or equivalent
b	Minimum temperature - °C	-60 or equivalent
c	Temperature deviation in time - °C	± 1 or equivalent
d	Spatial temperature variation over the module area - °C	±2 or equivalent
e	Temperature change rate	The rate of change of temperature should be up to 200°C/hour under full load conditions
f	Humidity Stability - %	3 % RH or better
10. Control and Programming		
a	Colour touch panel	VGA graphic, background-lighted LCD display language English
b	Program Memory	100 Programs
c	Password protection	two levels, to prevent accidental setting
d	Limit value monitoring system	for temperature and humidity to be provided
e	Diagnostic system	for information on operating times and possible operating failure.
f	Serial interface	RS 232/USB for bidirectional connection to a computer system for networking
g	Graphical check of the program	The temperature/humidity cycle programming Should be displayed on the panel for immediate visual check
h	Printing and storage of Program	Should be stored/printed in graphical form as well as in tabular form.

i	Control System	There should be provision for auto resume for test profile during power interruption. There should be provision for entering program ramp steps in time or °C
11.Connections/Others		
a	Power supply	3/N/PE/AC 415 ± 15%, Volts 50 HZ or 230 ± 5% Volts 50Hz
b	Grounding Requirement	Supplier to specify in detail.
c	Protection types	Test cabinet IP 22, Electrical/ Operating panel IP 54 (or any relevant International Standard)
d	Maximum connected load	Supplier to specify with details for load requirement sub-system wise
e	Maximum current consumption	Suppliers to please specify
f	Cooling water requirement - °C	Supplier to specify quantity of water inlet at 35°C input water. Also specify pressure at inlet.
g	Humidification water : (reservoir).	Fully de-mineral (conductivity max. 20 µS/cm, Ph value 6-7) Automatic supply from integrated RO system (to be supplied with the chamber along with constant level
h	Condensation drain	If required, please specify quantity and grade
i	Compressed air supply on site	please provide the details
j	Weight of chamber	Supplier to please specify
Note 1	The admissible ambient temperature range for satisfactory operation of the chamber should be from - °C	10 ± 2 to 45 ± 2
Note 2	Manufacturer should ensure that the system is designed for ease of maintenance. For example, the motors used for air circulating should be easily accessible for demounting and re-fixing as and when required.	Supplier to please specify
Note 3	Warranty	Minimum 3 years warranty must be provided

2021-22/04/11 - Fatigue Testing Machine		
S.No	Technical Specification	
1	Maximum Bending Moment - Kg.cm	<ul style="list-style-type: none"> • 200 kg. cm • Bending Moment Adjust: 100, 150 & 200 kg. cm.
2	Gripping Specimen Diameter - mm	12 mm
3	Test Specimen Diameter - mm	8 mm
4	Rotating Speed - RPM	4200 RPM or equivalent
5	Accuracy of applied Bending Moment - %	1%
6	Revolution Counter	8 digit

7	Fatigue Testing Software	<ul style="list-style-type: none"> • Software having provision for user interface containing specimen description, loading parameters, graph display, numeric readouts of multiple relevant test parameters. • Plot the S-N diagram for particular material tested. • Number of revolution taken by specimen up to its break point should be displayed on the digital counter. • The machine working phenomenon meets all the requirement of IS 5075-1959.
8	Accessories	The manufacturer shall recommend along with the price, list of the spare parts sufficient for a period of two years trouble-free operation of complete system
9	Installation, Commissioning & Performance guarantee	<ul style="list-style-type: none"> • The Supplier shall be responsible for carrying out the Installation and Commissioning at customer site. • Shall provide guarantee for the satisfactory performance of the system for a period of TWO year after satisfactory installation and commissioning at Purchaser's site. • Complete training should be provided at the site.
10	Technical support and service	Manufacturer should have established after sales & service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 48 hours of need.

2021-22/04/12 - GC-MS with Pyrolyzer and Headspace		
S. No	Technical Specification	
1	Applications	Separation and identification of solids/liquids/gaseous and their mixtures that includes unknown samples, polymers, pesticides, organic compounds, pharmaceutical ingredient etc.
2	General Technical	
	Gas Chromatograph system	Instrument detection limit should be ≤ 4 fg OFN for Statistically derived at 99 % confidence level from the area precision of 8 sequential splitless injections of 10 fg OFN standard. MS/MS transition of m/z 272 & 222 using 30m long colum
3	Ionization mode	Electron Impact (EI)
4	Detector	Flame Ionization Detector (FID) should be provided which can be coupled with the Gas chromatographic system.

5	Data acquisition /operating system	Data acquisition /operating system System should be capable of supporting two inlets and three detector ports simultaneously; should have electronic pneumatic/pressure controls for all the gases and should have Chromatography Data system which is based on Microsoft Windows operating system for instrument control, data acquisition, data analysis, quantization, automation & customization with online and offline sessions provided.
6	Provision	The system should have post-column backflush capabilities using Advanced flow technology to eliminate long bake-out times for highly retained (or high-boiling) contaminants.
7	Column Oven	
	Columns	Provision to install atleast two column
8	Operating temperature	450°C or more
9	Temperature set point resolution	0.1°C or better
10	Maximum temp ramp rate	120 °C /min or more
11	Cooling rate	From 450 °C to 50 °C: within 4 minutes or better
12	Temperature programming	Should have minimum 15 ramps & 16 Plateaus
13	Head Space Analyzer	
	Injection system	Loop based or syringe based system
14	Sample	Should able to handle all type of VOC
15	Incubation Temperature	35 C to 200 C or more
16	Head space vial	Vial capacity 12 or more and upgradable to 70 or more vial capacity
17	Pyrolyzer	
18	Make and model	Bidder to specify
19	Type	Multi-shot pyrolyzer compatible with GC-MS
20	Temperature range	Upto 1000 deg.C or better
21	Furnace cooling rate	Temperature to go down from 800 deg.C to 50 deg.C within 10 min.
22	Sample to be analyzed	Solid and viscous liquid
23	Control	Should be provide with controll software
24	Injection port	
	Injection port	1. Split/Splitless injection port with electronic pressure control (EPC)/ programmable pneumatic control(PPC) /advanced flow control (AFC) with fast GC capability • Programmable vaporizer injector and programmable up to 8 ramps (or better); Heating rate 500 deg.C/min. or better • PTV inlet configured with liquid N2/ PELTIER cooling & Air should have maximum temperature of 400deg.C and support sub-ambient temperature setting upto -3deg.C using Cryo gas.
		Possible to use capillary columns of 100µm to 530µm columns
		Digital display of gas flow, temperature etc.

		Manufacture's software controlled (AFC/EFC/APC/EPC controlled).
25	Pressure range	100 psi or better
26	Maximum temperature	400 C or more
27	Heating zones	Should have independently heated zones
28	Auto Injector-liquid	An automatic injector device having a capacity to hold at least 15 vials capacity and should be field upgradabale to 150 vial capacity
29	GC Detector Specifications (FID)	
	FID detector	Having an MDL:<1.5pgc/s or better
	Linear dynamic range	107 or better
	Carrier gas head pressure setting	Should be more than 650kPa or more
	Mass range	m/z up to 1000 unit or better
	Mass Analyzer	Should have inert/metallic quadrupole massfilter with pre-filter or equivalent technology
	Mass axis stability	Should be ± 0.10 amu over 48 hrs
	Scan speed	up to 10,000 u/sec or more
	Ion source temp	upto 350 C or better and it should be programmable. It should be cable less source for easy cleaning and maintenance. Additional a pair of filament should be provided.
30	Ionization mode	EI
31	Filament	Dual and automatic switching
32	The sensitivity of system should be a followed and demonstrated at site	EI MRM S/N: 1 μ L of 100 fg/ μ L of OFN produces > 15,000:1 RMS for the transition of m/z 272 & 222 using 30m x 0.25mm x 0.25um
33	Turbo Molecular Pump (TMP)	255 L/sec or better capacity
34	Resolution	Selectable, 0.7 to 2.5 Daltons,
35	WorkStation Instrument Control Software	GC and MS system should be combined with the same workstation for simultaneous settings and programming.
		Should have Auto tune (to optimize MS parameters automatically) feature
		A user friendly automatic data collection and analysis system compatible with Microsoft Windows OS and Microsoft Office suite applications
		NIST Library should be provided.Support to be provided for updation of library
36	Sample preparation	Qucheers Kit: 2 No.
37	Spectral Library	Latest mass spectral library (NIST) to be supplied in CD (licensed) for polymers including rubbers, additives, pesticide, insecticide, etc.
		Branded latest suitable PC compatible with GC-MS system having HDD Graphics display, 20"LCD/LED Monitor alongwith a good quality printer (should specify the PC and printer model).
		UPS: 10 KVA UPS with at least 60 min back up is needed.

38	Accessories	High quality He, H2, N2, Argon & Zero Air gas cylinders alongwith compatible regulators, gas purification panel for the above mentioned four gases,and required tubings should be provided.
		Syringes for manual and autosampler injection (minimum pack of 10 each), Filaments (minimum 2 no.), capillary column (minimum 1 no., desired 2 no.).
		Mechanical accessories (tool-kit etc) and consumable spares (Vials, Septa, Ferrules etc.) for the operation and maintenance of the instrument should be provided to meet our needs for at least 1 year.
39	Other terms and conditions	Installation Qualification (IQ) and Operational Qualification (OQ) should be performed at the time of installation and commissioning.
		The system must be factory tested and a certificate should be provided
		The entire system should be installed by the company professionals at oursite. A thorough technical training (minimum 3 days) in analyzing and troubleshooting should be given by the technical professionals
		A list of references in India,where similar systems have been installed,must be provided and this will be taken very seriously while making the decision.Your post sales service feedback will certainly be a deciding factor
		Complete set of manuals on operation, maintenance of the system in hardcopy as well as soft copy should be provided in English.
40	warranty	2 years

2021-22/04/13 - GLOSS TESTER		
S. No	Technical 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	Required angle	20, 60 & 85 degree Angles Triple geometry display
4	Measuring Area	20 degree: 10 mm X 10 mm 60 degree: 9mm X 13 mm 85 degree: 5 mm X 38 mm
5	Range	0 – 1500 GU (Gloss Unit) or higher
6	Repeatability	±0.2 GU or better
7	Reproducibility	± 0.5GU or better
8	Measuring time	0.5 Seconds/geometry or better

9	Power Supply	230 V & 50 HZ (With the battery model)
10	Calibration	Automatic by means of built – in Microprocessors
11	Operating Temperature range	15 – 40 °C
12	Memory	999 Measurement values with the date and time.
13	Digital Display	Alphanumeric LCD
14	Data transfer	Bluetooth, PC compatible, USB connection
15	Accessories	Calibration holder with standard tile with valid calibration certificate
16	Other Mandatory Items	While supplying the Machines, the supplier should also provide the following items apart from above:
		· Hard copies of Operational & Service Manual- 01 Set..
		· Machine should come with all other essential accessories, computer& spares required for installation, commissioning& Operation
		· Onsite Training to be provided for CIPET staff at commissioning site.

2021-22/04/14 - Glove Box Set up		
S. No	Technical Specification	
1	Purpose	ü Storage of air sensitive chemicals and fabricated devices.
		ü Fabrication of high end electronics, energy storage and energy conversion devices
2	Glove box	Glove boxwith 4 port
3	Moisture level Requirements	< 1ppm or lower
4	Oxygen Level Requirement	< 1 ppm or lower
5	Leak rate	< 0.05 Vol%/h
6	Environment	Nitrogen and Argon
7	Material of construction	Stainless Steel of high quality (grade to be mentioned by bidder)
8	Box Windows	ü Scratch resistant polycarbonate windowwhich can retain pressure range of -15mbar to+15mbar
9	Pressure	ü Automatic Pressure control from- 15 mbar to+15mbar with oil free over pressure relief valve.
		ü Continuous Digital Pressure monitoring of the glove box.
10	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 PLC based control system. Provision for 24/7 remote monitoring facility is required.

11	Box	· Scratch proof coating to protect the inner and outer housing
		· Dust filter of 0.3 micron
		· Gas inlet and outlet filter.
		· 3 height adjustable shelves
		· 3 Electrical feed through
		· Stand for the box along with levelling
		· Foot pedal control of the internal pressure
		· Waterproof
12	Antechamber Large	· One antechambers made up of stainless steel with metal doors which can be interlocked to maintain pressure range of -10 mbar to 10 mbar.
		· Pressure gauges to monitor the pressure.
		· Metal Sliding tray to transport sample.
		· Manual Control of Vacuum and Refill process.
		· Door lock easy to operate with a spindle lock system.
		· One large antechamber for transporting larger volume inside the glove box. At least 390 mm diameter, 600 mm length.
13	Antechamber Small	· Small Antechamber to allow transfer of Min. 100 mm Petridis diameter.
		· 3 way valve control with analog pressure gauge.
14	Gas purification	ü Closed loop gas purification with attainable moisture and oxygen level of < 0.1 ppm over complete pressure range for the complete volume of gas.
		ü Accessories and columns required for the gas purification should be provided by bidder.
15	Circulation Unit	ü Suitable blower with 80m ³ /hour or better capacity should be provided with the unit for adequate circulation along with other accessories.
		ü Should be fitted with heat exchanger and suitable recirculation unit.
16	Regeneration	Automatic regeneration control and electronic control of inlet and outlet of regeneration gas.
17	Vacuum Pump	Rotary Oil Pump of industrial grade which will be capable of running 24hours. The pump should have an oil mist filter and control for gas ballast. 17m ³ /hour capacity or better.
18	Control System	Rotary vane mechanical vacuum pump with necessary moisture and vapour traps details should be provided.
19	Running Time	The instrument and the ancillary vacuum pumps should be capable for running 24 hours.
20	Box Dimensions and number of ports	ü Suitable dimension (min. 2000 mm length) to allow minimum 04 port in front to be used for accessing the box.
		ü Typical dimension of each glove port would be 200mm-220 mm diameter.

21	Chemical Storage Requirements	The glove box and its parts should be compatible for storage and usage of
		· Organic solvents both chlorinated and unchlorinated.
		· Use of electrolytes and ionic liquids
22	Box Light	· Intermittent usage of acids and bases
22	Box Light	1 tube light front mounted with adequate illumination.
23	Valves and Piping	· Pneumatic Valve to control pressure in case of gas shut down for at least 12 hours.
		· Stainless Steel Piping
24	Oxygen Analyzer	· PLC controlled analyzer to monitor from 1–1000ppm
		· Solid state type
		· Should be free from frequent Calibration
		· Operating Temperature: 15 to 35 °C
		· Pressure - 800 - 1200 hPa
		· Sensitivity - 10 mV/ppm(v) or better
		· Response time- < 10 sec or better
		· Accuracy: +/- (2 % of displayed value + 1 ppm)
		· Zero Stability: 1ppm/24 h
		· Repeatability: +/- 1% in full range
		· Resolution: +/- 0.1% in full range
		· Probe/ analyzer type to be provided
25	Moisture Analyzer	· In-house calibration procedures to be provided
		· PLC controlled analyzer to monitor from 1–500ppm
25	Moisture Analyzer	· Solid state type
26	Filters	Charcoal Filter or better system for moisture removal to achieve the required level of moisture as specified.
27	Catalyst for Oxygen	Suitable technology for oxygen removal to achieve the required level as specified
28	Energy Conservation	Any energy conservation technology would be preferred
29	Others	Ø Piping and fittings Should be made of stainless steel
		Ø Electrical · Lighting: Internal LED/fluorescent lamp and provision of electrical points inside the chamber with leak proof sealing
		Ø Operating voltage: 230 V (±10 %), 50 Hz
		Ø Power and receptacle/socket as per Indian Standards should be provided.
30	Accessories	Ø Additional 03 pair of gloves and O rings
		Ø Rotary oil
		Ø Nitrogen and argon cylinder with regulator
		Ø Required additional accessories should be provided.
		Ø Appropriate tool box/kit for routine maintenance should be provided with the equipment.

31	Eligibility Criteria	Ø Supplier or its Authorized Agent should have ISO or equivalent international standard certificate.
		Ø Supplier or its Authorized Agent should have Export Experience of Similar products
		Ø Original Invoice, Original Warranty Certificate, Original Test Reports should be produced for all imported items from OEM (Original Equipment Manufacturer) at the time of supply of the equipments.
		Ø System Catalogue & Accessories catalogues like Rotary Pump, oxygen analyser, moisture analyser, filters should be provided along with Technical Bid
		Ø Supplier will support the user with all the spares for a minimum period of 10 years.
		Ø Bidder has to submit audited accounts (Balance sheet profit and loss account) of last 3 financial years. Audited statement must be signed and stamped by qualified chartered accounted.
		Ø Supplier or its Authorized Agent must have supplied minimum 5 nos. of similar equipments to Government labs / Govt. Institutions / Universities, etc.
		Ø List of Organization names with user details to be submitted along with offer where similar type supplied earlier to above said institutions / Universities / etc.
32	Utilities	Ø Details to be provided in the offer for space, power supply, gases, etc. for system operation
33	Manuals	Ø Operation Manual to be given after installation and acceptance of equipment. original softwares relevant to the instrument and its accessories must be supplied.
34	User Training	Ø Training for 1-2 users should be provided to make them well familiar with the operation of various components using the given glove box unit.

2021-22/04/15 - HDT / VSP TESTER		
S.No	Technical Specification	
1	No. of Stations	6 Stations (3 for VSP & 3 for HDT)
2	Temperature Range	Ambient to 300 C, Temperature Measurement – at each station separately
3	Display and control	Digital, LCD and PLC control system, Equipment with the facilities to store the data for interpretation (PC with installed Software - Window based control & data acquisition software
4	Accuracy	± 0.1 C
		ü Stainless steel

5	Chamber material	ü Jacketed bath to have cooling water circulation
6	Rate of Heating	2 ± 0.2 /min (HDT); 50 ± 5 /hr (VICAT)
7	Load	Suitable load increments for fibre stress of 66 & 264PSI (HDT test) and 10 N & 50 N (VSP test)
8	Deflection and penetration measuring range	0.01~ 5.00 mm (digital sensing)
9	Support span	Adjustable and detachable both for HDT & VSP test
10	Other Features	(i). Programmable water cooling system should be provided to cool the oil after every
11	Warranty	Minimum 3 years warranty must be provided

2021-22/04/16 - Inverted Metallurgical Microscope, Image analysis software and spares

S. No.	Technical Specification	
1	Microscope Type	Inverted metallurgical microscope with infinity corrected & par focal optics.
2	Microscope Stand	<ul style="list-style-type: none"> • Shall be designed for easy handling of control knobs • Frame should be equipped with front port C-Mount Camera attachment to provide 1:1 image area on camera monitor & eyepiece observation.
3	Illumination	<ul style="list-style-type: none"> • Reflected light illumination • Light Source: White LED (with Light Intensity Manager) /12 V, 100 W halogen lamp/100 W mercury lamp/light guide source
4	Observation Modes	Following field selection using selection mirror unit: <ul style="list-style-type: none"> i. Bright field, ii. Dark field, iii. Polarized Light & iv. Differential Interference Contrast modes of observation. Upgradable to MIX (combination of Bright field & Dark field) observation.
5	Observation Tube	Wide field tiltable binocular tube with adjustable eye point. <ul style="list-style-type: none"> • Focusable vertical tube for Digital Microphotography.

6	Objective lenses	<p>i. Plan Apochromatic type objectives shall be based on Infinity Correction system that should optimally correct chromatic aberration in the entire visible range.</p> <p>ii. Magnification: From 50X to 1000X using a set of 5X, 10X, 20X, 50X & 100X objectives lenses.</p> <p>iii. Working distance: Objectives 50x, & 100x shall have a working distance of 1mm.</p>
7	Focusing system	<p>i. 2 stage focusing mechanism with co-axial control knob.</p> <p>ii. High sensitive focusing knob in 1 μm increment, with focusing stroke 22 mm or more.</p> <p>iii. Torque adjustment ring and upper limit stopper for coarse focusing.</p> <p>iv. Co-axial focusing system with large knobs, pre-focusing lever & tension adjustment ring.</p>
8	Mechanical Stage	<ul style="list-style-type: none"> • Mechanical stage has low positioned co-axial controls on ball bearing guide ways. • Upper port with phototube for micro photography.
9	Eye Piece	Wide field eye piece 10X, with suitable provision for inserting eyepiece reticules.
10	Scales	<p>i. Scale slider with attachable 3 glass scales.</p> <p>ii. Calibration scales for each objective</p> <p>iii. Grain size scale applied to ASTM E112 Austenite grains in steel plate IV Nos. 1 to 8.</p> <p>iv. Parfocal glass to adjust the light path length.</p>
11	Nosepiece	Sextuple revolving nosepiece with a slot for analyzer or DIC slider
12	Magnification Changer	Magnification Changer 1X and 2X
13	C-Mount Adaptor	C-Mount Adaptor should have a built in facility to synchronize focus through eyepiece & on Monitor. Image area seen through eyepiece & monitor should be near to 1:1.
14	Digital Photomicrography	Specification
		Microscope Digital camera - For photomicrography an 14 MP, image sensor shall be provided
		Resolution - 4096 X 3288
		Sensor - 1/2.3"
		Scanning Mode - progressive scan type
		Exposure control - automatic, manual,
		Spectral Range - 380-650nm (IR- cut filter)
Software - Display/Film/Video		

		Interface - Camera head: IEEE1394b (9 pin) For desktop PC system: USB-3 connectivity to be provided
15	Image Analysis Software	<p>Image capture and processing software for microscopy applications with focus on acquisition, measurement and reporting.</p> <ul style="list-style-type: none"> • System should have provision for up-gradation of features as & when required using add on modules to existing software. • Measuring and dimensioning: • Measurement environment suited to interactive measurement tasks and dimensioning. <p>The following types of measurement shall be supported:</p> <ul style="list-style-type: none"> • Point, quantity, linear, open polygons and angles; measurements of enclosed areas such as circles, ellipses, rectangles and polygons. <p>Criteria available for tool selection include the following:</p> <ul style="list-style-type: none"> • Length, angle, point, number of points, area, perimeter, diameter, shape, etc. • autonomous calibration should be available <ul style="list-style-type: none"> a. Magnification lists and control of automatic microscopes. b. Zoom feature for fast and easy location of subtle including edge detection and smoothing filters. c. Functions for labeling/annotating within images.
16	Report Generation	<p>The software should have provision to select a user defined document template for report generation with following requirements</p> <ol style="list-style-type: none"> 1. Segmentation 2. Lamellar Graphite study as per ASTM A 247 3. Study of porosity as per ASTM B 276 4. Coating Thickness as per ASTM E 1077 5. Study of Spheroidization 6. Grain size as per ASTM E 112 7. Decarburisation as per ASTM E1077 8. Colour coding for different phases
17	Accessories	<p>Essential accessories like power cord, Vinyl dust cover etc. has to be included in the package. Polarizing/Analyzer rotatable at 360°. Polarizer & Analyzer can be slide in/out of the optical path. All necessary accessories to be provided along with equipment.</p>

18	Computer System with printer	<p>PC with Intel- i5 processor (latest version)</p> <p>i. Minimum 19” High resolution colour LCD monitor</p> <p>ii. 1 TB Hard disk (minimum)</p> <p>iii. Keyboard, Mouse, DVD/CD writer, USB ports</p> <p>iv. Uninterrupted power supply (half an hour backup)</p> <p>v. Operating system: Windows 10, 64 bit (from OEM)</p> <p>vi. Microsoft office 2016 or better version with license.</p> <p>vii. Color printer to be provided</p>
19	Scope of supply	Bidder should supply complete start up package necessary to prove the machine and provide training.
20	Installation, Commissioning & Performance guarantee	· The Supplier shall be responsible for carrying out the Installation and Commissioning at customer site.
		· Shall provide guarantee for the satisfactory performance of the system for a period of THREE years after satisfactory installation and commissioning at Purchaser’s site.
		· Complete training should be provided at the site.

2021-22/04/17 - Melt Flow Rate Tester		
S. No	Technical Specification	
1	Scope	Determination of flow properties of polymer powders & granules
2	Standard	ISO 1133 (1991) and ASTM D1238, Method A, B & C and other equivalent International standards.
3. TECHNICAL SPECIFICATION:		
a	Temperature range	50 to 400 Degree C
b	Temperature display resolution:	+/- 0.1 C
c	Thermal stability:	+/- 0.2 C from 50 to 400 Degree C with thermal fuse protection
d	Data acquisition	MVR with up to 20 data points acquisition for a single test (with encoder)
e	Barrel Cylinder:	Hardened Nitride Steel
f	Display	<ul style="list-style-type: none"> • On-board LCD Display with alphanumeric keypad for methods setting and visualization of results. • Should be equipped with high accuracy encoder and motorized lifting device to allow precise and exact positioning of the lifting device for the masses.
g	Cutting device	Automatic cutting device

4.ACCESSORIES:		
a	Masses	1.2, 2.16, 5, 10, 21.6 kg
b	Nozzle	Standard Nozzle as per ISO 1133/ASTM D1238 Diameter 2.095 mm, Length 8 mm,, tungsten carbide; should be supplied with dimensional conformity certificate
5	Other accessories	Cleaning Tools & Cleaning cream
		Go-No-Go Gauges for dies and piston
		CRM with NIST traceable certificate
		Die Plug
		Windows based software
		Die According to ASTM D1238 Method C (Half Die), for high flow rate polyolefins, Dia 1.048 mm, Length 4.00 mm, - Made of tungsten carbide; should be supplied with dimensional conformity certificate
		Spare Standard Die/Nozzle and Piston
		Fuses and Thermal Probe
		The equipment should be supplied with all the essential accessories to meet the standard methods mentioned above. The Basic start up kit including material for calibration shall be provided by the supplier. NIST traceable Calibration certificates to be provided with equipment
6	Warranty	Minimum 2 years warranty must be provided

2021-22/04/18 - Micro compounding Machine with Micro Injection moulding Unit		
S. No	Technical Specification	
1	Design	vertical/horizontal type with Co-rotating screws and counter-rotating screws
2	Sample quantity requirement of the Extruder	10 cm ³ by volume or higher
3	Extruder Heating	The extruder should include electrically heated controlled heating zone with an adjustable temperature range and the operating temperature should be 350°C or better.
4	Cooling of the extruder	Water and air cooling
5	Pressure measurement Sensors	The extruder must include pressure sensors capable of measuring high pressures of 150 bars or better
6	Main drive	The main drive of the extruder should include digital RPM adjustment with a provision for torque measurement. 200 RPM or better by means of a frequency controlled drive.

7	Instrument control – integrated PC based control and monitoring	PC based Data documentation, Control and acquisition rheological software. Storage of test setup and test results. The software should be operatable under Window platform.
8	Essential accessory	Strand Die compatible with the extruder, Set of rod dies (0.5, 1.0, 1.5 and 2.0 mm diameter)
9	Rheological Measurements	The extruder must have a back-flow channel which should re-circulate the extrudate back to the extruder to enable control of the residence time and to measure viscosity.
10	Bypass operation	Automatic bypass operation for circulation/extrusion
11	Inert environment	Extruder should be equipped with an inert gas flush system
12	Torque on screw:	5 Nm / screw or better
13	Thermocouple	Standard thermocouple for measurement of temperature
14	Pressure sensor	Standard pressure sensor for measurement of stress
15	Computer	Standard specification
16	Standard tools	All standard accessories for handling and cleaning
MICRO INJECTION UNIT		
17	The Micro Injection Moulding Machine	Piston based injection molding system
18	Compatibility	The machine must be capable of being used as standalone unit AND in conjunction with above Micro Twin Screw Extruder with force feeder
19	Pressure requirement	Must not be more than 10 bars
20	Maximum Injection pressure (bars)	1000 or more
21	Maximum Mould temperature (°C)	250°C or better
22	Maximum injector temperature (°C)	350 °C or better
23	Mould for Test specimen	Tensile, DMA, IzodCharpy, Flexural, thermal conductivity (disc) as per ASTM
24	Standard tools	Screw type Air Compressor (10 Bar, 40 SCFM) with Air Drier and other accessories (acoustic)
25	Accessories	Bidder to specify and quote any other accessories required for the better utilization of the equipment
26	Scope of supply	Bidder should submit complete scope of supply (Machine, standard accessories, Optional Accessoriestc with make model) in the technical bid with our price. Bidder should supply complete start up package including material necessary to prove the machine and provide training.

2021-22/04/19 - Microinjection moulding Machine	
S.No	Technical Specification
Injection Unit	

1	Stroke volume - cm ³	8 to 12
2	Screw Diameter - mm	upto 14
3	Shot weight - g	6 & above
3	Injection & holding Pressure - bar	1600 & above
4	Max. Screw Speed - rpm	Min. 300
5	Melt temperature - °c	400 to 450
6	Heating Capacity - kw	Min, 3 KW
Clamping Unit		
7	Clamp Force, Maximum Daylight, Platen size, opening stroke, ejector pattern etc to be provided for the machine as per standard construction as applicable - kN, mm	Injection force: up to & at 10 bar 12 kN (1200 bar), at 16 bar 18 kN (1800 bar) opening stroke/ mold open etc arrangement Shall comply
General		
8	Main Controller -	Microprocessor Controls should be provided like HMI touch screen with Micro processor / PLC control and digital display by PID controls also please mention the type of controller used , USB port for data copying
9	Servo drive or Electric drive -	Servo/Electric
10	Total connected Load - KW	Min. 3
11	Mould cooling circuit -	Should comply
12	Computer connectivity -	Should comply
13	Chiller unit to cool the mold in combination with cold mold	should comply if applicable
14	Set of Mould for Test specimen for Tensile, Izod, Charpy, disc as per ASTM or ISO	Specimens of ISO standard generated from mold. This helps in performing tests in tensile, Impact, Flexural etc with good reproducibility and uniformity in the results as the specimens are produced from one single mold.
15	Drier unit suitable for above machine	Should comply if applicable
16	Essential/Standard spares	Specify and Quote for 1 set (Standard Tool Kit, Thermocouple, Band Heater, Nozzle, Mould Clamps, Etc.)
17	Annual maintenance contract (AMC)	Quote for 3 year AMC without spares, Minimum 4 visit per year

2021-22/04/20 - MICROPROCESSOR CONTROLLED INJECTION MOULDING MACHINE (150 T)		
S. No	Technical Specification	
Injection Unit		
1	Shot Capacity (In GPPS) - g	200 and above
2	Screw Diameter - mm	40 - 50
3	Screw L/D Ratio	20 - 24:1
4	Injection Pressure - Kg/cm ²	1600 and above
5	Injection Speed - cc/sec	160 and above
6	Injection Rate - cc/sec	200 and above
7	Plasticizing Rate (Gpps) - gm/sec	Min. 40 and above
8	Screw Speed - rpm	300 and above

9	Heating Capacity - KW	upto 10
10	Bi- Metallic Screw Barrel	Should comply
Clamping Unit		
11	Clamp Force - ton	150
12	Mould Opening Stroke - mm	400 and above
13	Maximum Daylight - mm	1000 and above
14	Minimum Mould Height - mm	Min. 200
15	Maximum Mould Height - mm	400 and above
16	Platen Size - mm	600 X 600 and above
17	Distance Between Tie Rod - mm	450 X 450 and above
18	Ejector Stroke - mm	150 and above (Multi point and Multi Stage)
19	Ejector Force - Kn	50 and above
20	Mould Weight Capacity - kg	1000 and above
21	Hydraulic Multiple Core Pulling Unit	4 Core pulling
22	Multi Stage Air Ejection	Quote for minimum 5 point)
23	Clamping Mechanism	Toggle type
General		
23	T Slot Platen	T Slot is Preferred
24	Injection unit on LM guides	Should comply
25	Robot Interface	Should comply
26	Hot Runner Interface	Quote for minimum 4 Zones
27	Interface for Gas Assisted Injection	should comply
28	Water inlet & outlet manifold for Mould cooling	Min. 12/12 Channel
29	Computer connectivity	should comply
30	Hopper loader cum drier	Quote for 60 ltr capacity
31	Essential/Standard spares	Quote for Standard Tool Kit, NRV-2 Nos, Thermocouple, Band Heaters, Short/Extended Nozzle, SSR, Proximity Switch, Limit Switch, Mould Clamps, T-Nut and Studs, Etc.,
32	Safety	The machine or set of machines supplied to meet objective shall be able to operate without any risk or hazard without any additional protection, provision, training or guarding devices and meet current international standard.
33	Motor / Pump Type	Servo
34	Motor load	pls mention
35	Machine Dimensions (LxWxH) - mtr	6 x 1.5 x 2
36	Total connected load - KW	upto 45, lower preferred

2021-22/04/21 - Modulated Differential Scanning Calorimeter (MDSC)	
S. No	Technical Specification
	Measurement of the following properties of polymers, rubbers, elastomers etc
	· Measures heat absorbed or released by a sample as a function of time, temperature and environment
	· Glass transition temperature (T_g)

1	Purpose	· Melting temperature (T_m),
		· Crystallization temperature (T_c)
		· % of crystallinity,
		· Curing temperature
		· Degree of cure
		· Purity
		· Activation energy
		· Heat of enthalpy
		· Heat of fusion
		· Kinetic studies (isothermal/non-isothermal)
		· Thermal stability
		· Oxidation/decomposition
		· Oxidative-Induction Time (OIT)
· Specific Heat		
2	Principle/Definition	MDSC is a thermo-analytical technique to investigate the response of polymers to heating cycle.
3	Reference Standard	ASTM D 3417-99, ASTM D 3418-15, ASTM E 1356-08(2014), ISO 11357-1:2016, ASTM-D 3895-14
4	System	System shall be capable of running in conventional DSC mode as well as Sine wave modulated DSC mode
5	Temperature Range	-150 °C to 700 °C
6	Temperature Accuracy	± 0.1C or better
7	Temperature Precision	± 0.05 °C or better
8	Heating/Cooling Rate	0.01 °C/min to 100 °C/ min or higher
9	Oscillating (modulated) heating rate	± 1.0 °C/min. Or better
10	Furnace	To be constructed of corrosion resistant material suitable for rapid heating/cooling and should have long lifetime.
11	Calorimeter Sensor	Thermopile or constantan TZero Thermocouple
12	Calorimeter Baseline Repeatability / Stability/ Flatness	<30 μW or better
13	Maximum Calorimetric Sensitivity	0.2 μW or better
14	Calorimetric Precision (based on metal standard)	± 0.10% or better
15	Dynamic Range	± 200 mw to 500 μW
16	Temperature Calibration	5 points calibration over the full temperature range
17	Baseline Noise (max. peak to peak)	0.1 μW or better
		· Operating software and analysis software shall be user friendly and shall be running on windows 7/10 version

18	Software	<ul style="list-style-type: none"> · Analysis software shall have the provision to smoothen to evaluate peak temperature, onset temperature, glass transition temperature, melting temperature, Vendors should offer all major software as above with offer.crystallization temperature % of crystallinity, purity, curing temperature, activation energy, heat of enthalpy, heat of fusion, kinetic studies, Oxidative-Induction Time (OIT), X-scaling w.r.t time, temperature, etc.
		<ul style="list-style-type: none"> · The software shall have the provision to view total heat flow, modulated heat flow, total heat capacity signals in real time during experiment.
		<ul style="list-style-type: none"> · Software for kinetic studies (to be supplied with one licence as the same can be used with TGA) for single and multiple steps through non-linear regression
		<ul style="list-style-type: none"> · The data analysis software should be unkeyed or multi-user licensed to allow installation at minimum 3 PCs Calibrations shall include baseline, cell constant and temperature. Scheduling capabilities must be present, such that these calibrations and/or verifications can be programmed to perform during normal quiescent periods, such as overnight or on weekends.
		<ul style="list-style-type: none"> · The data file format should easily allow sharing/transfer of data files as individual electronic documents, which are readable by the same data analysis package.
		<ul style="list-style-type: none"> · The operating software should also be capable of periodically and automatically checking for updates via an Internet connection, and downloading/installing those updates if desired.
		<p>Library,</p> <p>Compatible to Windows 7 or higher OS (32 and 64 bit) and should have the capabilities to heating rate, temperature setting, etc. and capable of collecting data on heat flow, heat capacity enthalpy change, Cp, Tg, Tm, Tc, peak area, peak onset, etc.</p>
19	Measurement Atmosphere	N ₂ or O ₂ or air or helium
20	Provision for cooling	Inbuilt cooling system & accessories with variable cooling rates as specified above.
21	Control system	Built in Gas mass flow control system with auto gas switching option within the test run.
		DSC shall include:
		<ul style="list-style-type: none"> · 01 no. of Platinum pan with lid,
		<ul style="list-style-type: none"> · 01 no. of Graphite pan with lid
		<ul style="list-style-type: none"> · 100 nos. of Copper pans for OIT test
		<ul style="list-style-type: none"> · 800 nos. of TZero Aluminium pans with lid.

22	Accessories	<ul style="list-style-type: none"> · Standard samples such as Indium, Adamantane with Traceable calibration Certificate for calibration purpose. · Crimper and die set to be supplied along with the Instrument for sample preparation of both dry powder and liquid samples. · Cooler System for -150 to 700 C range · Liquid Nitrogen (LN₂) system with a Dewar of 50L capacity or suitable system in order to achieve the required temperature upto -150 °C and maintain the temperature during the test duration and over all comply with the other performance requirements. · Gas Tubing & fittings-01Set · Moisture dryer-01Set · PC of required configuration with original software · 01 no of filled N2 gas cylinder with two stage SS Gas regulator of best quality with tubing fittings · 01 no of filled O2 gas cylinder with two stage SS Gas regulator of best quality with tubing fittings.
23	Calibration Certificate	Calibration certificates for supplied reference material traceable to NIST and internal calibration report to be provided.
24	Personal Computer (PC)	<p>A Personal Computer having latest configuration.</p> <p>All softwares shall be loaded in the hard disk with appropriate partitions. All original CDs/DVDs must be provided</p>
25	Power Requirement	100-240 Volt, 50/60 Hz
26	Others	<ul style="list-style-type: none"> · Modulated DSC shall have the ability to apply sinusoidal temperature wave to sample by amplitude and frequency. · Modulated DSC shall include the ability to perform quasi-isothermal experiments i.e. holding isothermal with a small temperature modulation. · Modulated DSC should be able to show the following signals in real time during the experiment: Total Heat Flow, Total Heat Capacity, Reversing Heat Capacity, Reversing Heat Flow, Non-Reversing (Kinetic) Heat Flow, Modulated Temperature, Modulated Heat Flow, Heat Flow Phase, Reference Sine Angle, Temperature Amplitude, and Heat Flow Amplitude. · DSC shall allow for the direct measurement of specific heat CP i.e. in one single scan.
		While supplying the Machines, the supplier should also provide the following items apart from above:

27	Other Mandatory Accessories	· Basic tool Kit-01 set
		· Hard copies of Operational & Service Manual- 01 set
		· Necessary Hoses & Nipples required -01 set
		· The Machines should come with all other essential accessories & spares (as per ASTM & ISO standards) required for installation, commissioning & operation.

2021-22/04/22 - Optical Blue Light 3D Scanner		
S.No	Technical Specification	
1	Make/Model	Bidder to specify
2	Camera & pixel size	Dual camera with at least 8 Mega Pixel resolution having blue light projector
3	Scanner & Light Source	Optical Blue LED light based 3D Scanning system.
4	Measuring Volume	Minimum 2 measuring volume to cover small part to large size part measuring 1.5 m or higher
5	Acquisition Time	Should be 2 seconds or less
6	System Accuracy	To be reported as per VDI 2634 – Part 3 with following accuracy for different Scanning volumes as below:
		Small FoV
		a. Probing Error Form 0.005 mm
		b. Probing Error Size 0.01
		c. Spacing Error 0.01
		Medium FoV
		a. Probing Error Form 0.010
		b. Probing Error Size 0.030
c. Spacing Error 0.035		
7	Data Transmission	Between sensor and data acquisition system should be through Ethernet or Thunderbolt
8	LED Bulb Life	Minimum 10,000 hours or better
9	Calibration	Certified calibration plates covering all measurement volumes to be supplied
10	Transport Box & Casing	Transport box and casing to be supplied
		Supplied Mounting and Handling system of the Sensor could be handled by a single person.
		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.
11	Mounting and Handling System	Scanner should have 10 meter sensor cable
12	Rotary Table	Rotation of rotary table should be auto- synchronised with scanning software.
		One axis rotary table of diameter 300 mm (minimum) and load capacity 20 kg (Minimum) to be supplied. Resolution: 1° (or better), RPM- 7

13	Guided Pointers	The system should be equipped with guided pointers for setting of optimum standoff distance
14	Stand-off Distance	500 -700 mm
15	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).
		No manual setting of focus is needed, either at projector or at camera.
16	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.
17	Merging Scanned Data	Should have the ability to merge scanned data using different methods
		Merging of back or front side should be with or without use of reference marker
18	GD & T Analysis	All GD & T measurements as per ISO and ASME (User selectable)
19	Datum Creation	Should facilitate datum creation and local coordinate system
20	Sectional analysis	Color base sectional analysis with uniform and non-uniform tolerance band
21	2D Analysis	Tolerance and deviation Computations for sections and surfaces
22	Report Format	Should be capable of graphical report presentation in pdf
23	Import CAD Data Formats	IGES and STEP
24	Import of point clouds and polygons	OBC, ASC, TXT, STL, PLY
25	Export of point clouds and polygons	ACS, POL, STL, TXT
26	Data export to statistics Programs	CSV format
27	3D Comparison	3D comparison with CAD/Mesh to generate color report.
28	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.
30	Auto Exposure	Automatic monitoring of calibration, transformation, movement and positioning for each single measurement
29	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
30	Draft Angle Analysis	Should be able to do draft angle analysis in color

31	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
32	Hardware & Software Make	Should be from same make software and hardware for hassle free and smooth operations in future.
33	Material Thickness Analysis	Full-surface computation of material thickness based on polygon meshes
34	Onsite Calibration	VDI 2634 – Part 3 Calibration & accuracy certification should be done at on site.
35	Surface Defect Analysis	Surface defect analysis and classification to determine surface quality of sheet metal and plastic shall be possible in the inspection software.
36	Curve Bases Analysis	Should be able to do character curve and curvature analysis
37	GD&T Form Deviation	Color plot presentation of form error feature of GD&T (flatness, roundness etc) on points and mesh data
38	Strain Analysis	System should be capable to do strain analysis for material testing with add on software (Hardware same)
39	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.
		Software should be parametric. Software should be capable of 3D data acquisition, processing and 3D color comparison as well as 2D comparison
		System should be capable to do large size part with add on photogrammetry system upto 10metre.
		The software shall provide online display of sensor position and live image mapping
		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.
		Automatic transformation by measurement data by reference points or best fit of surface
		Import /Export of scan data in STL, ASCII, POL etc
		Mesh editing by filling holes, smooth, thinning, repairing etc
		Facility of Augmented view for inspection report
		Import of CT volume data (VGI, VGL, PCR, EXV, REK) as a polygon mesh

Complete geometric measurement such as point, line, circle, slot, rectangle, vector, plane, cylinder, sphere, cone etc.
Fitting elements feature (maximum inscribed and minimum circumscribed elements, Gaussian and Chebyshev methods) should be possible
Tracing and evaluation of curvatures and character lines
Silhouette section facility for 2D inspection
Multisections (axis parallel, radial, along curves and in viewing direction)
Cylindrical /conical base section and unroll section
Distance measurement using virtual caliper shall be possible. Software shall be capable to calculate curve length.
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
Curve base analysis like flush and gap, curvature etc
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.
The software shall provide polygonization of random point clouds into polygon meshes.
Multiple alignment with hierarchical order in same project should be possible.
Tracing and evaluation of curvatures and character lines
Complete traceability of constructions and evaluations`
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.
Multiple copy of analysis software for report creation .No need to keep scanner ideal for analysis and report.
Analysis of material allowance control shall be available in the software.
Software should be certified by PTB & NIST.
Able to find surface and Section enclosed area
Analysis of bending distance, radius analysis, hemmed edge analysis, trim line & spring back should be possible

		Arc length and continuous curve distance for analysis of deviation.
		Should have disk and edge caliper for distance measurement.
41	Laptop	Latest configuration Workstation laptop with minimum 64GB RAM
42	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.
43	Documentation	· Operational Manual (User Manual)
		· Software Instruction Manual
		· Maintenance and troubleshooting Manual
		· Training Manual
		· Installation and Commissioning
		· Handling of accessories
		· Software key (for operation, if any)
		· Software CDs
44	Calibration Plates	· Calibration Plate with International STD VDI Certification for all FoV
		· 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.
45	Software capability	Software should be capable of Reverse Engineering, Design and Inspection
46	Any other Accessories	Any other Accessories, if available for better utilization - Bidder to specify and quote
47	System	The System shall be catalogued items from a company. All the relevant catalogues shall be enclosed in the technical bid.
48	Scope of supply	Attach list for scope of supply
49	Installation requirements	Bidder to specify , pre-installation requirement
50	Installation & Training	Basic and Advanced training should be provided a minimum 6 days
51	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.
52	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
53	Warranty and guarantee	The machine shall be guaranteed for at least Three years for replacement and service against any design, manufacturing and workmanship defects , PARTS SUPPLY 07 Years Assurance

2021-22/04/23 - Pantograph Engraving Machine		
S.No	Technical Specification	
1	Pantograph ratio Min./Max	1:10/1:1.5

2	Work Table	
2.1	Clamping area - mm	(200-250) x (340-450)
2.2	Max. Distance-Spindle Nose to Table Top - mm	350-400
2.3	Longitudinal Traverse - mm	250-310
2.4	Cross Traverse - mm	150-180
2.5	Copy Holder Table Clamping Area - mm	(300-350) x (425-475)
2.6	Swivel Range - deg.	360
3	Main motor - HP	0.5 - 0.75
4	No. of spindle speeds	04 to 06
5	Speed range - rpm	450-12000
6	Accessories	Set of accessories suitable to the machine
6.1	Single Lip Cutter Grinder with standard accessories	
6.2	Set of tool holding devices	
6.3	Clamping Kit	
6.4	Letter templates (Positive & Negative) with template holder	
6.5	Standard accessories like stylus holder, stylus etc.	
6.6	Collets of different sizes (3, 4, 5, 6, 8, 10 & 12 mm)	
6.7	One set of manual	
6.8	One set of service tools	
6.9	Anti Vibration pads	
7	Others	Bidder to specify and quote if any other accessories available /required for smooth running of the machine
8	General features :	Bidder to specify the features of the machine
8.1	The specification of feed drive motors with make, model no., max. & nominal torque	
8.2	Preferably the guide ways of all axes should have telescopic type protective covers with adequate sealing on joints to prevent seepage of dust & coolant oil inside. Guide ways should be of hardened steel with hardness HRC60 or more	
8.3	The machine must have rigid streamlined and vibration free construction. All gears must be case hardened and ground and all the slides should be rigid to withstand heavy stock removal. It should have independent main drive and feed drive motors. Anti-vibration pad is to be provided for reach leg of the machine.	
9	Any Others Accessories	Bidder to specify and quote if any other accessories available /required for smooth running of the machine.

10	Terms & Conditions	Manufacture/Supplier should have sizable installations of same or better model worldwide and at least Five in India which is education institutions centrally funded institution. A Satisfactory Performance certificate from two institutions to be provided for eligibility. Bidder should submit complete contact details
		Equipment should be CE certified
		Authorization Letter from OEM
		List of clients in last five years to be provided.
11	Scope of supply	Bidder should submit complete scope of supply (Machine, standard accessories, Optional Accessories etc with make model) in the technical bid without price. Bidder should supply complete start up package necessary to prove the machine and provide training.
12	INSTALLATION, COMMISSIONING AND TRAINING	
12.1	Installation and commissioning requirements	Bidder should state the space required and condition of floor and any other requirements for installation of the machine and equipments. State clearly the specifications of electrical requirement. Vendor should carry out installation and commissioning of the machine and its accessories on a turnkey basis.
12.2	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
		· Software instruction
		· Maintenance and trouble manual
		· Training
		· Installation and Commissioning
		· Handling of accessories
		· Software key (if any)
· Software CDs		
12.3	Warranty	The whole system and its accessories should be given two years warranty for the machine and three years for the spindle replacement and service against any design, manufacturing and workmanship defects from the date of installation and commissioning.
12.4	Technical support and service	Manufacturer should have established after sales & service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 48 hours of need. Technical support personnel must have adequate experience in this field. Technical support personnel details should be submitted. Name and address of the authorized service centre/ partner in India along with the certificate of authorization should be attached.

12.5	Annual Comprehensive Maintenance Contract (ACMC) as optional	Vendor should quote for Annual Comprehensive Maintenance Contract for the whole system and accessories supplied after the completion of performance warranty period. Supplier has to provide service support within 48 hours. Calibration of the machine shall be a part of warranty and ACMC. It shall also be mandatory to perform calibration after every major repair or breakdown
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2021-22/04/24 - PARTICLE SIZE ANALYZER		
S.No	Technical Specification	
1	Mode of operation	Dry mode and Wet mode (suspensions, emulsions)
2	Laser	Class 1 laser HE-Ne or equivalent (CE compliant)
3	Size range	<ul style="list-style-type: none"> · Minimum detection of at least 10nm · Maximum detection of at least 3000µm
4	Control system	Automated measurement
5	Volume units	User Exchangeable volume units
6	Laser power	Power of light source must be minimum of 3mW
7	Detectors	Multi-Element Semiconductor based photo detectors to capture a smallest diffracted angle
8	Data display and interpretation	<p>Data display and interpretation unit must have facility to generation of reports like size distributions, density distributions, cumulative distribution, percentages, tabular, logarithmic, normal distributions.</p> <p>The computer system should capable of showing good quality images along with a laser printer</p>
9	Angular range	0.015 to 144 degrees or equivalent
10	Time	Measurement time must be less than 30 seconds
11	Operating temperature	System should be capable of taking measurement from ambient to 40°C temperature
12	Software	Software should run stand-alone for off-line data analysis, with guaranteed protection of original measurement data.
13	Others	<ul style="list-style-type: none"> • Vacuum cleaner, • air compressor • All required Spare parts should be provided:
14	Accessories	<ul style="list-style-type: none"> • Should be supplied with compatible computer and printer • Other accessories for independent running of the equipment
15	Warranty	Minimum 3 years warranty must be provided

2021-22/04/25 - PENDULUM IMPACT TESTING MACHINE(DIGITAL)		
S.No	Technical Specification	
	Equipment	Pendulum Impact Tester to be provided for testing of Izod & Charpy Test. The test methods confirm to IS: 1598-1997, 1757-1973, 1499-1977, 3766-1977 as well as BS: 131-part 1,2,3,4 1972. The pendulum should be mounted on antifriction bearings.
	Type	Charpy Test - Izod Test
1	Pendulum Impact energy	300 J or equiv. - 164 J or equiv.
2	Pendulum drop angle	140° or equiv. - 90° or equiv.
3	Pendulum effective weight	20,996 Kg or equiv. - 22.059 Kg or equiv.
4	Min. Scale graduation - j	2 J or equiv. - 2 J or equiv.
5	Striking velocity of pendulum - m/sec	5 to 5.5 m/sec - 3 to 4 m/sec
6	Distance of axis of pendulum rotation - mm	825 mm or equiv. - 825 mm or equiv.
7	Angle of Striking Edge - degree	30° - 75°
8	Radius of Curvature of Striking Edge - mm	2 mm - 0.5 mm
9	Maximum Width of Striker - mm	18 mm
10	Distance Between Supports - mm	40 mm
11	Angle of Inclination Supports - degree	75° to 80°
12	Standard Accessories:	Charpy Striker R 2 mm - 1 No Izod Strike R 0.75 mm - 1 No. Charpy - Izod support Block - 1 no. Allen key Set - 1 set. Instruction Manual - 1 No. Software CD. - 1 No. All Sockets, connectors for electrical connection Caliper gauge checking V notch for Izod & Charpy Templates for checking 10x10mm. cross section of Izod/Charpy test specimen. Depth notch gauge including V & U notch gauges for checking depth below V/U notch, angle and radius. Self centering tong for quick and accurate setting of Charpy test specimen. 'V' notch milling cutter. 'U' notch milling cutter. Guards & Covers
13	Other features	Direct indication of impact energy absorbency by the specimen on digital display unit. Safety guard is provided for operator safety.

14	Installation, Commissioning & Performance guarantee	· The Supplier shall be responsible for carrying out the Installation and Commissioning at customer site.
		· Shall provide guarantee for the satisfactory performance of the system for a period of TWO year after satisfactory installation and commissioning at Purchaser's site.
		· Complete training should be provided at the site.

2021-22/04/26 - Planetary Ball Mill with cryogenic setup		
S.No	Technical Specification	
1	Applications	Size reduction, Pulverizing, mixing, homogenizing, colloidal milling, mechanical alloying
2	Feed material type	Soft, hard, brittle, fibrous – dry or wet (organic and inorganic)
3	Size reduction principle	Impact or friction
4	Material feed size - mm	< 5
5	Final fineness	Minimum fineness atleast below 100nm and maximum size below 1µm
6	No. of grinding stations	02 number of grinding stations
7	Batch size/Feed quantity - ml	Min. 2 X 50
8	Sun wheel speed - min-1	100 – 650
9	Effective sun wheel diameter - mm	150 to 160
10	Type of grinding jars	Optional aeration covers, optional cryogenic setup, safety closure device
11	Material of grinding tools	Zirconium oxide or equivalent
12	Grinding jar size - ml	Min of 125
13	Grinding Temperature control - °C	-70 to Ambient
14	Setting of grinding time	Microprocessor control, digital setup in hours, minutes and seconds
15	Interval operation	Interval operation with directional reversal and time setup
16	Method storage	Min of 10 numbers
17	Measurement of input energy	Option should be quoted
18	Computer interface	Should be provided with documentation facility
19	Accessories	Grinding balls of various sizes 2mm, 10 mm, 20 mm
		Grinding jars of Zirconium oxide /Zirconia/Equivalent material
		Cryogenic tank or supply system
		Accessory for grinding under inert atmosphere
		Consumable spare parts for 2 years for operation
		Minimum 3 years compliancy warranty with additional 2 years maintenance warranty must be provided in order to keep the equipment in continuous working condition.

20	Others	Onsite and offsite training at accredited laboratory as well as application support should be provided by the vendor at its own cost. 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.
21	Warranty	• Minimum 3 years warranty must be provided

2021-22/04/27 - Plasma Cleaner	
S.No	Technical 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	· The metering valve should be able to qualitatively control the gas flow and chamber pressure; it should have 1/8" national pipe thread (NPT).
10	· A 1/8"NPT 3-way valve should be there for quick in bleeding of gas, isolating the chamber and ventilating.
11	· Gas mixer allows quantitative control of up to two process gases and monitoring of vacuum pressure.
12	· Dual gas feeds for gas mixing or independent control of two process gases. Dual process gas flowmeters.
13	· Thermocouple vacuum gauge sensor connects to plasma cleaner door.
14	· Digital meter displays to measure the pressure range.
15	· 2 No of Quartz chamber and sample tray.
16	· 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.
17	· Nitrogen, argon and oxygen cylinder with regulator. Required additional accessories such as gas tube, connectors etc. should be provided.
18	· Additional vacuum gauge.
19	· Power: 230V AC \pm 10%, Single phase and 50 Hz.
20	· 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.
21	Eligibility Criteria

22	Ø Supplier or its Authorized Agent should have Export Experience of Similar products
23	Ø Original Invoice, Original Warranty Certificate, Original Test Reports should be produced for all imported items from OEM (Original Equipment Manufacturer) at the time of supply of the equipments
24	Ø System Catalogue & Accessories catalogues like Pump, sensor etc. should be provided along with Technical Bid
25	Ø Supplier will support the user with all the spares for a minimum period of 5 years.
26	Ø Bidder has to submit audited accounts (Balance sheet profit and loss account) of last 3 financial years. Audited statement must be signed and stamped by qualified chartered accountant.
27	Ø Supplier or its Authorized Agent must have supplied minimum 5 nos. of similar equipments to Government labs / Govt. Institutions / Universities, etc.
28	Ø List of Organization names with user details to be submitted along with offer where similar type supplied earlier to above said institutions / Universities / etc.
29	General terms and conditions
30	§ Tenders should specify and quote the necessary accessories required for installation and running the machine.
31	§ Onsite training as well as application support should be provided by the vendor at its own cost.
32	§ Necessary spares and Consumable for 2 years
33	§ Appropriate tool box/kit for routine maintenance should be provided with the equipment
34	§ 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.
35	§ 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.
36	§ All documents (i.e. manuals, drawings etc.) and original software's relevant to the instrument and its accessories must be supplied

2021-22/04/28 - Polymerization Reactor		
S.No	Technical Specification	
1.Reactor		
a	Volume - L	3.0 or equivalent
b	Heating/cooling jacket Max. pressure: - bar	350
c	Max. temperature - °C	550
d	Jacket having bottom opening - inch	Φ 3/8
2.Material		
a	Product touched parts (liquid and gas phase)	Made of SS 316 Seals of modified PTFE
3.Reactor System		
a	MFCs for N ₂ or Inert gas	
	i. Max. inlet pressure: - bar	370
	ii. Max. outlet pressure: - bar	350
	iii. Flow rate: - ln/min	0.08 TO 4
b	MFC for Reactor outlet	

	i. Max. inlet pressure: - bar	200
	ii. Max. outlet pressure: - bar	150
	iii. Flow rate: - l/min	0.08...4
c	MFCs for N ₂ or Inert gas	
	i. Min. inlet pressure: - bar	5
	ii. Max. outlet pressure: - bar	500
d	Storage vessels (SV) : 2 nos.	
	i. Vol. - L	450bar/100°C¼"
	ii. With 4 openings	NPT each with
	iii. Bursting disc	450bar +/- 5% Tolerance
	iv. Pressure reducing valve	1 Nos
	v. Manual needle valves	2 Nos
	vi. Pressure transducer, with tubing and fittings - bar	1 Nos , 400
4.Syringe Pump (SP)		
a	Capacity - mL	500
b	Flow Rang - mL/min	0.001 – 200
c	Flow Accuracy (Maximum 1.0 µL/min seal leakage)	+ 0.5% of set point
d	Displacement Resolution: - nl/step	31.71
e	Pressure Range: - bar	1 – 350
f	Pressure Accuracy	0.5% FS Optional
g	Materials (Standard)	Nitronic 50, Graphite filled PTFE, TFE, Hastelloy C-276, Inert Polymers Plumbing
h	Operating Temperature: - 0C	Ports: 1/4" NPT 5 - 40
5	Catalyst Holder (CH) Tube: Volume of the tube: end closed by Both threaded nuts connected to 1/4" NPT with valve DN3 - mL	50, (ID: 1") SS 316
6. Heating-Cooling Circulator		
a	Dimensions - mm	230x230x580
b	Working temp - °C	-40....400
c	Pump max.- l/min	14-18
d	Heating capacity - bar	0.8-1,2 3kW
e	Cooling capacity - °C	12 kW at 350
f	Temp. control. - °C	8 kW at 250°C
g	Temp stability - °C	4 kW at 150°C
h	Display: display - °C	1 kW at 75°C External via Pt100
i	Heat transfer oil - °C	±0.01-0.1°C LED / LCD 10 L silicone oil, -40 to +400°C with necessary connecting metal hoses
7. Display		
a	Temperature (displayed and controlled-thermostat)	
b	Speed (displayed)	
c	Agitator on/off	

d	Pressure (displayed)	
e	Actual flowrate (displayed and controlled)	
f	Sum of dosed gas (displayed and controlled)	
g	Data login	
h	Remote control pc via ethernet	
Note: Design may by moderate		
a	Warranty	• Minimum 3 years warranty must be provided

2021-22/04/29 - Projection Microscope	
S. No	Technical Specification
1	Suitable for thickness measurement/flow path measurement.
2	Travel Scale (Horizontal & Vertical)
3	Least Count: 0.01 mm
4	Eye Piece: 10X lens
5	Objective Lens focal Length: 50mm
6	Telescope tube setting: Can be set Horizontally & Vertically.
7	suitable for distance measurement between ribs of emitters, fitted in inline emitting pipes, as per IS-13488 standard
8	Shall meet the requirements of IS-13487 & IS-13488

2021-22/04/30 - Punching Press		
S.No	Technical Specification	
1	Base to guide - 171mm	
2	Centre to back - 114mm	The specifications are indicative. Bidders shall specify their specifications of Punching press .
3	Diameter of screw - 46½	-
4	Hole through base (without ring) - 76mm	The press can be hydraulic type with adjustable height; Max. height 500mm;
5	Hole through base (with ring) - 38mm	Distance between columns : 300mm Min.
6	Stroke - 114mm	Shall be supplied with Punching dies of the following type : Hole in ram (Dia.) - 19mm Hole in ram (Depth) - 38mm Diameter of flywheel - 536mm Height of the body - 631 mm

7	Cutting Dies	Dumbell/Rectangular specimen cutting dies as per ASTM D 638 (Type 1 to 5); IS 4984, IS 12818, IS 13592, IS 14151, IS 12701, IS 12786 etc.,
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2021-22/04/31 - Selective Laser Sintering - PolymerPlastic		
S. No	Technical 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 (polymide), 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	Powder based additive manufacturing system (Latest Selective Laser Sintering system)
2	Build Volume	Minimum build volume 200 x 200 x 200 mm or more Complete build volume to be achieved without stopping the building process.
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 ₂ , 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.

2021-22/04/32 - Spin coater		
S.No	Technical Specification	
1	APPLICATION	· It is used to coat the polymer & nanomaterials on various substrates for different applications
2	Configuration :	· The top plate assembly of spin coater with spin bowl/head
		· The spin coater should be clean room compatible
		· Fast, simple programming by means of microprocessor-based control
3	Spin Parameters	· Spin Speed: 10 – 12000 RPM or better
		· Speed Accuracy: < 1% or better error across
		· Acceleration/ Deceleration: 10 – 10000
		· Time: 1-999 sec or more with increment of 1 sec or less
		· Spin speed stability : ± 1 RPM or better
4	Control parameters :	· Spin cycle: One cycle should have up to 16 steps with control of acceleration/deceleration.
		· Spin parameters like spin speed / number of steps /acceleration / deceleration / step time.
5	Hot Plate	· In built with the coating system and capable of varying substrate temperature from 40 to 150°C or better
6	Spin cycle	· One cycle should have up to 16 steps with control of acceleration/deceleration
7	Substrate holder	· Suitable vacuum chuck/holder to handle substrates of various size upto 4" wafer with integrated vacuum release switch for easy removal of substrates.
		· Suitable Fragment Adapter for (substrate size > 3mm to 15 mm and > 5 mm to 25 mm)
8	Display	· LCD touch screen with color real time display of speed (RPM) versus time

9	Motor	· Integrated brushless DC servomotor with closed loop digital speed control.
10	Gas purging connection	· Nitrogen gas purging facility should be provided.
11	Vacuum pump	· Oil free, Diaphragm pump with pumping speed ~ 75 lit/min
12	Safety interlocks	· All the standard safety interlocks should be incorporated, including vacuum switch interlock.
13	Vacuum connections	· Polyurethane tubing or equivalent for vacuum plumbing.
14	Power	· 230V AC \pm 10%, Single phase and 50 Hz.

General terms and conditions

§ Tenders should specify and quote the necessary accessories required for installation and running the machine.

§ Onsite training as well as application support should be provided by the vendor at its own cost.

§ Necessary spares and Consumable for 2 years

§ Appropriate tool box/kit for routine maintenance should be provided with the equipment

§ 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.

§ 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.

§ All documents (i.e. manuals, drawings etc.) and original software's relevant to the instrument and its accessories must be supplied

2021-22/04/33 - Thermal Conductivity measurement apparatus		
S.No	Technical Specification	
1	Equipment capable to determine measurement of Thermal Diffusivity, Conductivity and Specific Heat.	-
2	Temperature range - °C	-125 to 500 or equivalent
3	Thermal diffusivity range - mm ² /s	0.01 to 1000
Accuracy		
4	Thermal Diffusivity - %	3 or equivalent
5	Thermal Conductivity - %	4 or equivalent
6	Heating rate - °C	0.01
7	Pulse Source	Laser 25J/Puls or equivalent
8	Pulse Width - μ s	300 to 400 or equivalent
9	Measurement temperature	Contact less with IR detector
10	Measurement range of thermal conductivity - W/mk	0.1 to 2000 W/mK or equivalent
11	Sample dimensions - \varnothing	3, 6, 10, 12.7 ... 25.4 mm
12	Sample Thickness - mm	1 to 6 or equivalent
13	Sample holder:	metal/SiC/Graphite
14	Sample holder for liquids:	Required

15	Atmospheres:	inert, vacuum, Nitrogen
16	Accessories	Should include all accessories as required for running of equipments
17	Standard requirements	ASTM E1461, ASTM C714, ASTM E2585, ISO 13826, ISO 22007-Part4, ISO 18755
18	Computer system	Computer with suitable configuration to support the software and printer should be provided
19	Warranty	<ul style="list-style-type: none"> • Minimum 3 years warranty must be provided with additional 3 years contract to keep the equipment in continuous working condition. Part no.s of all parts for which warranty is not applicable should be specified in the quotation. • AMC charges for additional 3 years to be quoted separately.
20	Training	Onsite training for system operation and maintenance as well as application support to be provided by the vendor at own cost.

2021-22/04/34 - THERMAL EVAPORATOR	
S.No	Technical Specification
1	<p style="text-align: center;">Thermal Evaporation System</p> <p><u>VACUUM CHAMBER:</u></p> <p>Ø Material of Construction (MOC): SS 304 grade /Better;</p> <p>Ø Chamber size : Approximately 400 mm (W) X 400 mm (D) X 450 to 500 mm (H) [minimum requirement]</p> <p>Ø Necessary ports required for Pumping, evaporation sources, Gas Inlet, Vent, gauge, feedthrough, view port, mechanism etc.</p> <p><u>THERMAL EVAPORATION SOURCE:</u></p> <p>Ø 3 sets of LT evaporation electrical feed through and evaporation source holder for evaporation made of electrolytic pure copper, with 200 A current carrying capacity for sector evaporation source holder to be provided as a standard which can accept Filament / Basket / Boat as evaporation source.</p> <p>Ø 3 nos of 200 Amps power supply capable of delivering 200 A at 10 V, 100 A at 20 V</p> <p>Ø Thyristor Controller in the input circuit of LT selector provides the output power variation.</p> <p>Ø Digital panel meters provided for secondary current through current transformers.</p> <p>Ø Electromagnetic shutter with control panel for Thermal source</p> <p><u>IB CLEANING:</u></p> <p>Ø One HT electrical feed through to carry power for ion cleaning should be provided.</p> <p>Ø A bar type ion bombardment gadget should be fixed on the feedthrough to provide a uniform glow discharge.</p>

		<p>Ø A 5000V DC open circuit, 3500 Volts at 50mA high reactance type transformer and solid state bridge rectifier should be provided.</p> <p>Ø Thyristor based IB current controller with display should be there</p> <p><u>Rotary Work Holder:</u></p> <p>Ø The rotary substrate work holder and associated fixtures are designed to hold 4" wafer (100 mm) or multiple smaller size substrates.</p> <p>Ø The rotary drive mechanism is provided for the continuous rotation of the substrate with adjustable speed 5 rpm to 20 rpm.</p> <p><u>FILM THICKNESS MONITOR:</u></p> <p>Ø A Digital Thickness monitor with water cooled Crystal holder, and Oscillator to be provided to measure the in situ rate of deposition and Thickness. The DTM should have the following specification:</p> <p>Ø Rate Display: 3 digits LED auto ranging from 00.00 to 999 A°/sec.</p> <p>Ø Thickness display: 4 digits LED auto ranging from 0.000 to 999.9 kA°.</p> <p>Ø Static Thickness resolution: 1 A° at min. update rate.</p>
2	Vacuum Pumping System - (A)	<p><u>High vacuum pump:</u></p> <p>Ø A Turbo Molecular pump having suitable pumping speed (minimum 400 lit/sec) to achieve chamber vacuum level at least 1×10^{-6} mbar.</p> <p>Ø Detachable liquid nitrogen trap to be provided for fitting below the high vacuum valve and for use when needed.</p> <p>Ø Ultimate Pressure: $\leq 1 \times 10^{-6}$ mbar to be achieved</p>
	(B)	<p><u>Rotary Pump:</u></p> <p>Ø Dual stage rotary pump ($20 \text{ m}^3/\text{hr}$ or Higher) for roughing and backing operations.</p>
	(C)	<p><u>HIGH VACUUM VALVE:</u></p> <p>Ø Motorized high vacuum Poppet type valve with built in facility to automatically throttle the pumping system by 'cracking' the valve, for maintaining accurate process pressure for plasma processes.</p> <p>Ø Drawing of the Poppet valve should be provided along with the bid.</p>
	(D)	<p><u>VACUUM VALVES:</u></p> <p>Ø Electro magnetically operated right angle bellow sealed valves for roughing, backing and high vacuum applications</p> <p>Ø Electro magnetically operated Vent valve</p> <p>Ø Fine control needle valves to be provided</p>
		<u>SS Plumbing line & Collar</u>

	(E)	Ø SS Plumbing line with flexible hoses & KF connections wherever required with necessary interlocks to be provided
	(F)	VACUUM GAUGES: Ø Digital Pirani and Penning Gauges with display to be provided.
3	Mounting Frame /	Ø Necessary pumping systems can be accommodated below the stand
	Support Stand	Ø Must have castor wheels for mobility with arresting pads.
4	Spares & Consumables	Ø Set of O rings and gaskets – 1 set
		Ø Quartz crystals- 10 No's
		Ø Tungsten helical- 6 No's
		Ø Tungsten baskets – 6 No's
		Ø Molybdenum Boats – 5 No's
		Ø Rotary Pump Oil – 5 litres
		Ø Al metals (99.99%) 100 gm,
		Ø Ag metal (99.99%), 100 -gm
		Ø Au-wire (99.99%): 10 cm
		Ø Vacuum clamps with metal O-rings
		Ø Vacuum grease
		Ø Penning gauge (1 No.)
Ø Pirani gauge (1 No.)		
Ø All required tools		
5	Water Chiller	Ø Reputed Make water chiller unit of capacity of 0.5 TR to be provided with re-circulating pumps, storage tank, valves, gauges etc. for closed loop water cooling
6	Warranty	Ø 12months from the date of commissioning and acceptance of equipment
7	Special Criteria	Ø The thickness uniformity should be $\pm 5\%$ over 50mm (2 inch) diameter substrate. A measurement certificate of thickness uniformity of any metal (for example Al/Cu/Ag) on Si substrate of appropriate size should be provided with Technical Bid.
		Ø The thickness should be measured using ellipsometry/profilometer showing variation of thickness along the radius of the Si substrate.
		Ø The committee reserves the right to verify the certificate and thickness uniformity at the customer site/manufacturer site. If it is done at Manufacturer site, then Manufacturer has to arrange the necessary facilities for assessing uniformity.
		Ø Supplier or its Authorized Agent should have ISO or equivalent international standard certificate.
		Ø Supplier or its Authorized Agent should have Export Experience of Similar products

8	Eligibility Criteria	Ø Original Invoice, Original Warranty Certificate, Original Test Reports should be produced for all imported items from OEM (Original Equipment Manufacturer) at the time of supply of the equipments
		Ø System Catalogue & Accessories catalogues like Turbo Pump, Rotary Pump, digital thickness monitor should be provided along with Technical Bid
		Ø Supplier will support the user with all the spares for a minimum period of 10 years.
		Ø Bidder has to submit audited accounts (Balance sheet profit and loss account) of last 3 financial years. Audited statement must be signed and stamped by qualified chartered accountant.
		Ø Supplier or its Authorized Agent must have supplied minimum 5 nos. of similar equipments to Government labs / Govt. Institutions / Universities, etc.
		Ø List of Organization names with user details to be submitted along with offer where similar type supplied earlier to above said institutions / Universities / etc.
9	Utilities	Ø Details to be provided in the offer for space, power supply, gases, etc for system operation
10	Manuals	Ø Operation Manual to be given after installation and acceptance of equipment
11	User Training	Ø Training for 1-2 users should be provided to make them well familiar with the operation of various components and successful growth of the thin films using the given deposition unit.

2021-22/04/35 - Twin Screw Extruder for Compounding		
S.No	Technical Specification	
1	Extruder Type	Co-Rotating twin screw extruder Segmental type – Both Barrel / screw with cooling of screw & Barrel, venting System.
2	Screw Dia - mm	25 mm
3	L/D Ratio	Min - 40/1
4	D_0/D_i	Min – 1.55
5	Main Gear Box	High torque gear box
6	Screw rpm	Min - 600 rpm
7	Nominal Torque / shaft	70 Nm
8	Electrical control Panel	Digital Temperature Controller, Melt Pressure Indicator, Melt Temperature Indicator, Ammeter for Extruder dynamic Load, Tachometer for Screw Speed.
9	Water Bath	SS Water bath with rollers is Provided guiding the strands cooling.
10	Vacuum Degassing system	With Vacuum pump provided for degassing.
11	Air Knife	Suitable Capacity.
12	Strand Pelletizer	Suitable capacity of above machine.

13	Output - Kg/hr.	20 - 30
Feeding System		
14	Gravimetric Feeder - Kg/hr.	Suitable Capacity of Machine.
15	Twin screw feeder - Kg/hr.	Material Feeding - Low Density Material like Natural Fiber/Filler and Powder, etc.
16	Application	R&D, Compounding of all Engineering Polymers, Polymer blends & alloys, Fiber (Natural/Glass) Reinforced thermoplastics & R&D of Bio Polymers etc.
17	Dosing location for powder and liquids, Exchangeable barrel & screw element type, Integrated control, water cooling and vacuum unit, Pressure transducer, Melt temperature transducer, Pelletizer, automatic bypass operation for circulation/extrusion	Specify in details
18	Loader with vertical force feeder	Please specify and quote suitable for the above machine.
19	Max. Drive Power - KW	Specify
20	Total Connected Load - KW	Specify
21	Instrument Control Monitoring System	Controls should be provided ,hmi touch screen with Microprocessor and digital display controls. Please specify the type of controller used
22	Synchronization of Extruder drive with Haul off unit etc	Shall comply
23	Safety	Specify
24	Machine Dimensions (LXWXH)	Please Specify
25	Essential Spares	Bidder to specify the list of spares and quote any other accessories required for the better utilization of the equipment
26	warranty	3 years comprehensive warranty should be provided

2021-22/04/36 - Xenon arc weatherometer	
S.No	Technical Specification
Should be completely automated and capable of operating continuously with following facilities:	
1	Light source - Air cooled Xenon Arc Lamps
2	Sample compartment – Approx. 3000 Sq. cm or more
3	Microprocessor control required
4	Touch screen/key pad
5	Irradiance control required
6	Irradiance Sensors at 340nm, 420 nm & TUV range
7	Irradiance Calibration device for quick, easy, error free and automatic calibration
8	Optical Filter system to simulate outdoor / indoor testing
9	Filters should be of non-ageing type to avoid frequent change
10	Black Panel Temperature (BPT) Control
11	Black Standard Temperature (BST) Control
12	Chamber Air Temperature Control

13	Simultaneous control of BST & CAT required
14	Relative Humidity Control required
15	Provision of water spray front & back required
16	Data logging interface along with software
17	Capability of mounting and testing fabric specimens/Plastic Test specimens
18	Compliance to various international standards (ISO, ASTM and other standards)
(B) Accessories:	
1	Specimen holder set for Xenon test chamber.
2	One Set of Xenon Arc Lamps for Xenon test chamber
3	Other types of Filters (Window glass, UV/Extended UV) for Xenon test chamber
4	Suitable Radiometer with NIST Traceable calibration certificate for optional filters for Xenon test chamber
5	Black Panel Calibration Thermometer for Xenon test chamber
6	Provision for back spray and dual spray in xenon test chamber
All the other necessary accessories required for installation and commissioning of equipment shall be included in the scope of supply.	