

## Technical Specification for Tender No.2020-21/04

### 2020-21/04/01\_ Automatic Viscosity Measurement System

S. No	Items	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 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 <sup>2</sup> /s or better; Suction: 0.35 to ~5,000 mm <sup>2</sup> /s
7	Ubbelohde for dilution viscometry not calibrated, for automatic measurements	Total range 0.35 mm <sup>2</sup> /s to 60 mm <sup>2</sup> /s
		Capillary tube with Constant K values- Values to be specified
8	Temperature viscosity Bath : 01 no.	Temp. Range: RT to 100 °C; Resolution:0.1 ° C; Temperature Selection: digital
		Temperature stability:+/-0.1 ° C
		Temperature Display: To be specified
		Temperature Selection: Digital
		Digital Auto Start: Provided Low Liquid level Protection
		Pump pressure: automatically controlled
		Pneumatic connections threaded connections for viscometers

		Data Input/Output-To be specified
		Housing Material: To be specified
9	Other essential requirements	<p>Measured parameter flow through time [s] Accuracy of the time measurement <math>\pm 0.01</math> %</p> <p>Measured value display via PC Display accuracy <math>\pm 1</math> digit (0.1%)</p> <p>Pump pressure automatically controlled CRM materials should be supplied with the machine</p> <p>All the accessories and spare parts should be supplied for smooth running of the instrument</p> <p>Bidder to specify and quote any other accessories required for better utilization of the equipment</p>

### 2020-21/04/02\_ Cone Calorimeter with PC

S. No	Items	Specification
1	The Cone Calorimeter should be capable of measuring:	
2	Ø Heat Release Rate	
3	Ø Mass Loss Rate	
4	Ø Time to Ignition	
5	Ø Effective Heat of Combustion	
6	The apparatus should meet the standards prescribed in ISO 5660 and ASTM E 1354.	
	<b>FEATURES</b>	<b>DESCRIPTION</b>
7	Conical Heater	Ø The heater element should be rated at 5 kW (or better) at 240 V
		Ø The heater should be able to produce uniform irradiance over the range 0 to 100 kW/m <sup>2</sup> (or more)
		Ø The heater should be encased on the outside with a double-wall stainless steel cone, packed with a refractory fiber material of approximately 100 kg/m <sup>3</sup> density
		Ø The heater should be capable of horizontal and vertical orientation arrangements

		<p>Ø The heater should have three K-type stainless steel sheathed thermocouples, connected but not welded to heater element</p>
		<p>Ø The heater should have a shutter mechanism (automatic or manual) to protect the sample area before the test</p>
8	Temperature Controller	<p>Ø The temperature controller for heater should be capable of holding the element temperature steady to within <math>\pm 2^{\circ}\text{C}</math> or better, over the range of <math>0^{\circ}\text{C}</math> to <math>1000^{\circ}\text{C}</math> (or better) using a suitable 3-term PID controller and thyristor unit capable of switching currents up to 25 A at 240 V</p>
9	Ignition Circuit:	<p>Ø External ignition should be by 10 kV discharge across a 3 mm spark gap</p>
		<p>Ø A power source should be a transformer designed for spark-ignition or a spark generator</p>
10	Load Cell	<p>Ø Load cell should be compensating for imbalance in the fuel</p>
		<p>Ø It should have a readout resolution of 0.1 g or better</p>
		<p>Ø Total weighing range of minimum 3.5 kg of which more than 500 g should be available for direct monitoring during single test</p>
11	Specimen Mountings:	<p>Ø The specimen holder should be manufactured from 2.5 mm thick stainless steel material</p>
		<p>Ø The inside dimensions of holder should be 100 mm×100 mm and 25 mm height</p>
		<p>Ø Retainer frame and wire grid arrangements for specimen holder should be provided</p>

12	Heat Flux Meter	Ø Gardon or Schmidt-Boelter type heat flux meter to calibrate the heater temperature controller
		Ø The design range should be at least 0 to 100 kW/m <sup>2</sup> with an accuracy of ± 3 %
		Ø The sensing surface should be circular and flat
		Ø The flux meter should be water cooled
13	Calibration Burner:	Ø Calibration burner to be provided to calibrate the heat release rate of the apparatus using methane of at least 99.5% purity
		Ø Mass Flow Controller (MFC) to control the gas flow is preferred.
14	Exhaust System	Ø The exhaust system should consists of a variable speed exhaust blower capable of developing flow over a range 0.012 to 0.035 m <sup>3</sup> /s
		Ø A restrictive orifice of 57 mm inside diameter should be placed between the hood and the duct for mixing and a sharp-edged orifice of 57 mm inside diameter should be located at least 350 mm downstream from the blower as per ASTM E 1354, ISO 5660
		Ø The duct should be 114 mm inside diameter and manufactured from 0.6 mm thick stainless steel plate
		Ø K-type stainless steel sheathed thermocouples to measure temperature of gas stream
		Ø Material of complete exhaust system should be stainless steel

15	Smoke Detection System	Ø Helium-Neon laser beam (0.5mW, 633nm) system, silicon photodiodes as a main beam and reference detectors.
		Ø 2 number of ND filters for calibration with optical density anywhere between 0.1 to 1
16	Gas sampling and analysis system	Ø Capable of measuring O <sub>2</sub> , CO <sub>2</sub> , CO
		Ø Should incorporate a ring sampler, soot filter, cold trap, pump, desiccant, bypass system and flow controller
		Ø The gas sample lines should be constructed noncorrosive material like nylon and plumbing should be using Swagelok fittings
		Ø The gas sampling & analysis rack should be modular for use with both cone calorimeter and well as large scale calorimetry.
17	O <sub>2</sub> Analyser	Ø Paramagnetic type gas analyser with a range of 0 to 25 % oxygen
		Ø The analyser should exhibit a linear response
		Ø The drift of not more than ± 50 ppm of oxygen and noise of not more than 50 ppm of oxygen (root mean square value) over a period of 30 min.
		Ø The analyser should have 10 to 90% response time of less than 12 s
		Ø Intrinsic error (accuracy) should be less than 0.02% Oxygen
		Ø Absolute pressure transducer arrangement for analyser
		Ø Non-dispersive Infra-red (NDIR) type with a range of 0 to 10 % CO <sub>2</sub> (v/v)

18	CO <sub>2</sub> Analyser	Ø The response time should be less than 20 s
		Ø Intrinsic error (accuracy) should be at least 1% of range
19	CO Analyser	Ø Non-dispersive Infra-red (NDIR) type with a range of 0 to 1 % CO (v/v)
		Ø The response time should be less than 20 s
		Ø Intrinsic error (accuracy) should be at least 1% of range
20	Digital Data Collection System	Ø The system must have facilities to record output from the analysers, the thermocouples, the orifice meter, the load cell and the smoke measuring system.
		Ø The system should be capable of recording test data at least 1 scan per 1 second or better.
		Ø Mention the hardware and software (OS) specification of computer system (personal computer/laptop) to be provided by the user.
21	Software	Ø Software for showing the status of the instrument, calibrating the instrument and storage of calibration results, collecting data generated during a test, calculating the required parameters, presenting the results in a manner approved by the standards should be provided on a media.
		Kindly mention ability to provide the following optional. For each option please give the technical specifications (drawings if applicable) in the technical quote and extra cost of each individual option in the budgetary quote

22	Optional	Ø Additional heated analytical line (3 meter) and filter to enable taking combustion gases for further analysis
		Ø Step temperature controller (for adjusting conical heater's heat flux in steps)
		Ø A larger cone, which can be used for larger samples (say 150 mm×150 mm) for low heat release materials
		Ø A quartz tube of 114 mm I.D. and length 100 mm should be incorporated before gas sampling ring
		Ø Personal computer i7 8GB 21" 1Tb branded workstation as per the requirement of software for equipment
		Ø CACC (Controlled Atmosphere Cone Calorimeter) attachment.
23	Warrantee	Ø ACMC (annual comprehensive maintenance cost) for three years after expiration of warranty should be quoted

### 2020-21/04/03\_Dielectric Thermal Analyzer (DETA)

S. No	Items	Specification
<b>Applications</b>	Investigation of the curing behavior of thermosetting resin systems, composite materials, adhesives and paints.	
	➤ Suitable for films, liquid and powdered materials.	
	➤ To determine glass transition of delicate polymeric films and membranes.	
	➤ To study the dependence of temperature and frequency on dielectric properties.	
	➤ Provide information on capacitance and conductivity of materials.	
<b>Technical Spec.</b>		
1	Frequency range	12Hz to 200kHz Up to 50 frequencies in same experiment
2	Temperature range	-150°C to 350°C or better
3	Ramp Rate	2°C/minute
4	Heating/Cooling rate	Heating rate 0 to 20°C/min
		Cooling rate 0 to 20°C/min

5	Coolant	Automatic cryomode for measurement at sub ambient temperature using liquid nitrogen including dewar flask of 50 litre capacity (should be supplied along with instrument)
6	Voltage range	0.005 to 2 V
7	Electrode type	<ul style="list-style-type: none"> <li>➤ Parallel plates: 10mm, 33mm, 40mm</li> <li>➤ Cup: 40 mm</li> </ul>
8	Data acquisition /operating system	<ul style="list-style-type: none"> <li>➤ System should be capable of determining the dielectric constant, permittivity, loss factor, dissipation factor, glass transition, and other secondary transitions with the DETA.</li> <li>➤ Should have DETA data system which is based on Microsoft Windows10 operating system for instrument control, data acquisition, data analysis, quantization, automation &amp; customization with online and offline sessions provided.</li> </ul>
9	Voltage range	AC: 0 mV to 1.3V in 5mV step DC: 2V internal DC Bias and 30V external Bias 200mA max
10	Capacitance range	10pF to 10 $\mu$ F
11	Dynamic impedance	$10^{-5}\Omega$ to $10^5$ k $\Omega$
12	Tan $\delta$ resolution	> 0.0001
13	Humidity control chamber (Optional)	20°C to 90 °C Dry purge gas
14		<ul style="list-style-type: none"> <li>➤ Should be equipped with an efficient furnace for precise temperature control. Liquid nitrogen can be easily connected (automatic mode) to allow for sub-ambient measurements.</li> <li>➤ Bidder should specify the sample thickness and dimension</li> </ul>
<b>Essential Accessories</b>		
1		Branded latest 10th gen i7 PC compatible with DETA system having 2tb HDD and 2 gb Graphics display,8gb RAM 20" LCD/LED Monitor along with a good quality printer (should specify the PC and printer model).
		UPS: 5-7 KVA UPS with at least 60 min back up is needed.
2		Mechanical accessories (tool-kit etc.) and consumable spares for the operation and maintenance of the instrument should be provided to meet our needs for at least 1 year.
<b>Other terms and conditions</b>		
1		The system must be factory tested and a certificate should be provided.



2	The entire system should be installed by the company professionals at our site. A thorough technical training (minimum 2 days) in analyzing and troubleshooting should be given by the technical professionals.
3	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.
4	The entire system should be installed by the company professionals at our site. A thorough technical training (minimum 2 days) in analyzing and troubleshooting should be given by the technical professionals.
5	ACMC should be quoted for three years after warranty period

### 2020-21/04/04\_Electrospinning Unit

S. No	Items	Specification
1	Applications	Preparation of fibers from polymers solution; fabrication of nanofiber mats, fabrics, nanofilters and nanoscaffolds; should be capable of direct coating on substrates, like glass, fabric, etc.
2	X, Y and Z- axis stage	Programmed on the operation unit through PC/mounted panel control
3	Spinning direction	Vertical, should be controlled for three axis Individually; the spinning chamber should have humidity display, temperature control, inert gas purging facility and exhaust.
4	cospinning	Co-spinning option with coaxial fibres
5	Safety system	Safety door lock system to avoid electrical shock and an exhausting system to evacuate evaporated solvents and flying nanofibers.
6	Power supply control unit	0 - 30kV or better with emission current less than 10 mA, 50Hz; should have digital display for current and voltage monitoring.
7	Syringe pump	One movable syringe pump.
8	XY Traverse width	10- 300 mm with digital display of transverse speed.
9	Nozzles	Metallic needles; Single nozzle, multi nozzles, core-shell nozzle and co-axial nozzle; with minimum 4 different nozzle diameter. IDs to be specified by the bidder

10	Syringe unit	Four (syringe two for each syringe pump); capacity: 10, 20, 30 and 50 mL; should be fitted with a heater to heat up to 80 °C
11	Syringe pump feed rate	0.1-60 ml/min
12	Syringe Traverse Speed	10-100 mm/min
13	High Voltage Power Supply Device	0-30 KV (or better) digital display & voltage control device with complete safety to operator
14	Fiber Diameter	Should be capable of producing fibers of diameters 20 nm to 1 μm (inclusive of both)
15	Inner Diameter of Nozzle	100-500 nm
16	Drum Rotation Speed	60-3000 rpm
17	Temperature	Room Temp. to 45 ° C (or better) inside stink cupboard
18	Temperature controlling system, precision	±0.1 °C
19	Collector system	i. Plate Collector, (Disc area: A5 size (< 370 cm <sup>2</sup> ) (approx.))
		ii. Disc Collector, (Disc circumference: 600 mm (approx.), Rotating speed : 500 – 3000 rpm (approx.))
		iii. Drum Collector (Fiber Deposition area: to be specified by bidder, Rotating speed : 500 – 2500 rpm (approx.))
20	Safety measures	A door lock and static electricity removal device; protection from overload and sparking between electrodes; solvent-resistant PTFE tubing with solvent-resistant connector should be provided.
<b>TERMS &amp; CONDITIONS</b>		
21	1. Tenders should specify and quote all mandatory and other accessories required for installation, commissioning and running the machine.	
22	2. The vendor should supply PCs with requisite specifications and data transfer accessories compatible with the equipment.	
23	3. All necessary CRM along with the calibration certificates wherever required traceable to international standard should be provided.	
<b>WARRANTY</b>		
24	4. Minimum 3 years warranty must be provided with additional 3 year's maintenance contract (Optional) in order to keep the equipment in continuous working condition. Part numbers of all parts for which warranty will not be applicable should be specified in the quotation.	
25	5. AMC charges for additional 3 years should be quoted additionally.	
<b>PRE-REQUISITES</b>		

26	6. Pre-installation requirements indicating details of power requirement, utility air, water, ventilation, safety device, if any, along with the foundation requirement needed for installation & commissioning should be provided with tender document.
27	7. The vendor should have technical support in the area of application and service available within the country.
28	8. The power requirement of UPS for providing a back-up of minimum 01 hour should be specified.
	<b>SERVICE</b>
29	9. Appropriate tool box/kit for routine maintenance should be provided with the equipment
30	10. All documents (i.e. operating & service manuals, drawings etc.) and original softwares relevant to the instrument and its accessories must be supplied.
31	11. 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.
32	12. Power and receptacle/socket as per Indian Standards should be provided.
33	13. The vendor shall have local service and application office and infrastructure to attend by visit within 48 hours of need.
	<b>VENDOR TRACK RECORD</b>
34	14. The vendor should furnish details of customers in India.
	<b>TRAINING</b>
35	Onsite training for system operation and maintenance as well as application support should be provided by the vendor at its own cost.

**2020-21/04/05\_Fourier Transform Infrared (Ftir) Microscope (Micro-FTIR)**

Sl. No.	Description	Specification
1	Design	The microscope should be compact and include a full FT-IR spectrometer with interferometer for excellent sensitivity and wavelength stability
		The whole system should be equipped with parts that are inert to high humidity
2	Application	Should be applicable to microplastics, Quality Control, Polymers & Plastics, Pharmaceuticals, Material science, Automotive & Electronics, Mining, Exploration and Forensics

3	Wave length region	7500 - 450 $\text{cm}^{-1}$ or Better (extendable to higher wave number)
4	Spectral Resolution	1 $\text{cm}^{-1}$ or Better
5	Wave number accuracy	0.05 $\text{cm}^{-1}$ or Better
6	Signal to Noise (S/N) ratio	Better than 20000:1, 2100–2000 $\text{cm}^{-1}$ , 1 $\text{cm}^{-1}$ Resolution
7	Operating modes	Transmission, Reflectance, Absorption and ATR analysis using a motorized measurement mode
8	Interferometer	Permanently aligned interferometer with min 10 years of warranty.
9	IR Source	Should be high performance IR light source with min 05 years of warranty.
10	Beam Splitter, window and IR optics	ZnSe (For usage of FTIR microscope in high humidity climate) and
		KBr (for an extended spectral range)
		The optics should be protected from moisture.
11	Detector	MCT Detector (Capable of measuring with high resolution and sensitivity with and without liquid nitrogen cooling)
		High sensitivity DLaTGS /DTGS (optional)
12	Microscope objectives	Should be available with at least 8X objective for automated measurements.
13	Illumination	Independent white light LED illumination with apertures
14	Aperture	Motorized transparent aperture for precision positioning down to 5 x 5 $\mu\text{m}$ or equivalent
15	Sample view mode	Should have the facility to view the sample during FTIR measurement (Real time view and live trace)
16	Provision for additional attachments	•—The system should be upgradable to near IR and far IR.
		• The system should have provision to couple with TGA.

17	Accessories	<p>Traceable standard materials should be supported for calibration of spectrometer. Suitable sample holders should be supplied to analyze samples in powder / solid / film form. Automatic optimization and calibration, Suitable work station</p> <p>IR source with a laser diode for outstanding wavenumber accuracy and spectral stability.</p> <p>Purging kit to be supplied as per the requirement</p>
18	Instrument Calibration	<p>Suitable NIST traceable Polystyrene standards must be offered to check the performance of the FTIR as well as Microscope. Microscope performance must be checked in Transmission, Reflection, and ATR mode. Instrument qualification (IQOQ) using this standard must be performed.</p>
19	Software	<p>Compatible to Windows 10 and should have built in provision for ATR</p> <p>A licenced copy of complete FTIR spectral library of polymeric, organic and additive materials.</p> <p>Software must include the library for multicomponent heterogeneous samples.</p> <p>System should be controlled through appropriate software and interphases for quick and reliable data acquisition and analysis</p> <p>Fully automated switch-over through software between Far, Mid, and Near-IR spectral ranges.</p> <p>Require software able to perform operations like Qualitative and Quantitative analysis of spectra.</p> <p>Perform background scan, File save, display spectrum in different colours, Spectral calculator, spectral comparison, Processes, difference, derivative smooth, interpolation, normalize and baseline correction etc.</p>

		<p>Printing basic export like export to ASCII and XPS format in both Mid IR and NIR region.</p> <p>The software should be able to perform calculation using PLS/PCR/CLS/Beer's law as standard features.</p> <p>Data acquisition and storage should be automated in all measurement modes and results should be stored in a single file (preferable)</p>
20	Personal Computer (PC)	<p>A Personal Computer (PC) with 10<sup>th</sup> generation i7 processor, 2Terabyte HDD. Dedicated graphics card, Bluetooth Wifi, 21" LCD TFT Screen should be quoted. Software must be provided in CDs/DVDs. The scope of supply also includes a good (reputed make, please give the details) Colour Laserjet Printer having a resolution of 1200 x 1200 dpi or better.</p> <p>Authorised MS Office (Latest version) should be included in the quote</p>
21	Other Mandatory Items	<p>While supplying the Machines, the supplier should also provide the following items apart from above:</p> <ul style="list-style-type: none"> <li>• Hard copies of Operational &amp; Service Manual- 01 Set.</li> <li>• Machine should come with all other essential accessories &amp; spares required for installation, commissioning &amp; Operation</li> <li>• Onsite Training to be provided for CIPET officers at commissioning site.</li> </ul>
22	Warranty	3 years comprehensive warranty should be provided
23	Maintenance	The system should come with an initial annual maintenance cover (AMC) of minimum 03 years after warranty period.
24	Scope of supply	Complete scope of supply with make, model, quantity of each item with parts number should be provided.

## 2020-21/04/06\_Fusion Deposition Modelling System

Sl. No.	Description	Specification
<b>1</b>	<b>MACHINE</b>	
1.1	Technology	Solid based additive manufacturing system (Latest Fused Deposition Modelling , FDM )
1.2	Make	Bidder to specify
1.3	Model	Bidder to specify
1.4	Build Volume	Build volume between 200 x 200 x 200 mm and 275 x 275 x 260
1.5	Nozzles and extrusion Head	Dual Wear Resistance Nozzles. Must be capable of having e.g. water soluble for one nozzle for support creation and having another material for plastics on another nozzle for part creation.
		Nozzles diameter: 0.05, 0.1, 0.25, 0.4, 0.6, 0.8 mm
		Dual-extrusion head with auto-nozzle lifting system; capable of printing multiple build and support materials.
1.6	Layer resolution	Minimum 20 micron or better
1.7	Layer Thickness	0.05 to 0.8 mm with suitable steps or better range can be achieved using different nozzles.
1.8	Part accuracy	± 0.1% or better
1.9	Support structure material	Soluble and breakaway
1.1	Machine Control	Machine should be controlled in real time
1.11	Axis Positioning and Precision	X/Y (10~15 microns), Z (0.2~1 micron) or better
		The calibration XY gantry and Z stage has to be automated no operator intervention.
1.12	Print Speed	>25 mm <sup>3</sup> /s or higher
1.13	Calibration technique	Auto
1.14	Maximum Nozzle Temperature	400 °C or higher
1.15	Bed Temperature	100 degrees Celsius or higher
1.16	3D Builder Support (Platform)	Required
1.17	Monitoring	Live camera for tracking and monitoring of 3D building process
1.18	Filament Break Warning and Power off Resume	Yes (Flow Sensor)
1.19	Bed levelling	Automatic
1.2	Material recognition	Auto recognition with NFC scanner

1.21	Operating sound	< 50 dBA
1.22	Working zone	Closed (with a view glass)
1.23	Language	Multilingual
1.24	Connectivity	Wi-Fi, USB, LAN/SD card compatible
1.25	User Interface	Touch Screen
1.26	Control	Using computer with appropriate software. Software should display and control. Complete program of solution must be provided.
1.27	File Types	.stl, .obj, .gcode, .x3d, .bmp, .jpg, .png etc.
<b>2</b>	<b>MATERIAL</b>	
2.1	Material	<ul style="list-style-type: none"> <li>· Machine must have the ability to fabricate parts with open material option for ABS, ASA, PC-ABS, PLA, Flexible Rubber, High performance materials such as PEI, PEEK, glass filled and carbon filled composites etc.</li> <li>· Machine must have the ability to fabricate parts with the materials/filaments developed by the customer.</li> <li>· Provide list of all material option available.</li> <li>· Vendor should list all other available materials that are suitable for the quoted machine.</li> <li>· Machine should have the option to upgrade for currently available material and also for future materials.</li> </ul>
2.2	Material Quantity	Vendor should quote all possible materials and supply 5 Nos. of Canister on each material, excluding the quantity of material required for installation, training and calibration. Machine should be calibrated to fabricate parts with all the materials mentioned above at the time of installation.
2.3	Customised material guidance	Machine should have the provision of testing materials developed by the customer and professional guidance should be given to adhere to the system compatibility and configuration
2.4	Material Quality	Vendor should attach the quality certificate of each material with test report evaluating the parameters according to standards.



2.5	Material Property	Vendor should also supply proven parameters for all the suitable materials with clear documentation and statistics of the mechanical properties with respect to build orientation and layer thickness.
<b>3</b>	<b>SOFTWARE</b>	
3.1	Process Software	It should control the building process and have an ergonomic operating interface.
3.2	Software feature	Software should have the feature of addition, deletion and updation of part information during the time of fabrication with the option to continue to build from the same layer. Automatic and manual 3D nesting should be possible.
3.3	Slicing and data editing software	Software should have complete module for conversion of part data in the STL format and optimization of layer data. Should allow both manual error fixing and auto fixing of STL data. Should have a provision to add text or batch numbers to the STL file. Software should support other CAD file formats like STEP, IGES. Vendor should list all other supported file formats
3.4	Control and reporting	The software should report the job & part specific build data for quality requirements. It should generate statistical QA reports that can be reviewed in real time and for future documentation
3.5	Desktop Software	Vendor should supply independent software that operates on independent offline PC to prepare and evaluate the total build time that would be required to finish the job
3.6	License	License must be perpetual
<b>4</b>	<b>ACCESSORIES</b>	
4.1	Support removing system	As per the requirement to be quoted by the bidder
4.2	Consumables	Vendor should supply minimum quantities of consumables like build platforms, nozzle for all layer thickness, wiper blade, brush etc., required for 6 months

4.3	Compressor	Vendor 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.
4.4	Material station	· Material station with humidity control is required for fast and easy loading of filaments without uninterrupted printing.
		· Material auto recognition and seamless integration with software (NFC Scanner).
		· Material capacity minimum 5 spools.
		· Dual geared feeder with abrasion-resistant.
		· Filament diameter as per our requirement.
4.5	Air Manager	· EPA Filter
		· Air extraction with fan
		· Air refresh rate 150 m3/h or better
		· Compatible Software
		· Noise level <50dBA
4.6	De-humidifier	Vendor should supply suitable de-humidifier to maintain room humidity level within suitable range for machine operation.
4.7	Nozzles covers	Minimum 10 for each nozzles
4.8	Online UPS	Vendor should supply suitable UPS with minimum 60 minutes power backup for the machine and essential accessories. Should have built in safety to protect machine from voltage spikes and sudden surges.
4.9	Workstation with accessories	Vendor should supply suitable OEM workstation computer system with complete accessories and UPS. It should have minimum of 10th generation, 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
4.1	Tool kit	Vendor should supply standard tool kit for startup, removal of parts and cleaning (list to be attached).

4.11	Any other accessories required	Vendor should supply all the other accessories, material transport trolleys / carts and spares required for effective and better utilization of machine. All the required accessories should be listed
<b>5</b>	<b>OTHER ESSENTIAL REQUIREMENTS</b>	
5.1	Benchmark part	Vendor should submit two numbers of benchmark parts in two material which should be built in the quoted machine same is to be built during prove out of the machine at the site
5.2	Manufacturer's Credentials	Manufacturer should have sizable installations of same model worldwide and at least three same or similar models in India
5.3	Supplier's Credential	Supplier should have sizable installations of same model worldwide and at least three same or similar models in India. Supplier should submit complete contact details and acceptance letter from the recent customers
5.4	Safety Requirements	The machine and all the accessories supplied to meet objective should be able to operate without any risk or hazard, without any additional protection, provision, training or guarding devices and meet current international standards
5.5	Scope of supply	Vendor should supply complete start up package necessary to prove the machine and provide training. List for scope of supply to be submitted.
5.6	Environment Protection	The machine and all the accessories supplied should be safe to use without emission of any hazardous gases, noise level and radiation without any need for additional equipment, provision or training and meet current international standards

5.7	Consumables & accessories and their availability	List all such material that will be used in building part. Tender shall include list of all essential spares and consumables to be provided with replacement time prescribed for each such item and its availability within reasonable time period. In case if any such item is likely to be out of availability within service period of machine, such item shall be included in initial supply
5.8	Price list of material, spares and consumables	Price list of each material with minimum order quantity, machine spares and consumables are to be quoted.
6	<b>INSTALLATION, COMMISSIONING AND TRAINING</b>	
6.1	Installation and requirements	Vendor 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 the following items required for installation such as Transformer, chiller, UPS, Air conditioner, Dehumidifier, separate special earthing, vibration isolation and compressed air supply
6.2	Training and documentation	<p>Minimum of 5 days training for five persons which includes basic &amp; advanced level training. Training content and plan to be submitted. Training faculty must have adequate experience in this field.</p> <p>The vendor should supply the necessary manuals such as</p> <ul style="list-style-type: none"> <li>· Software instruction</li> <li>· Maintenance and trouble manual</li> <li>· Training</li> <li>· Installation and Commissioning</li> <li>· Handling of accessories</li> <li>· Software key (if any)</li> <li>· Software CDs</li> </ul>
6.3	Installation and requirements commissioning	The vendor should support necessary site preparation for installation. Vendor should carry out installation and commissioning of the machine and its accessories on a turnkey basis

6.4	Warranty	The whole system and its accessories should be given three years warranty for replacement and service against any design, manufacturing and workmanship defects from the date of installation and commissioning
6.5	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.
6.6	Annual Comprehensive Maintenance Contract (ACMC)	Vendor shall 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

### 2020-21/04/07\_Impedance Analyzer

Sl. No.	Description	Specification
1	Application	Measurement of the dielectric, ferroelectric, piezoelectric properties of the materials.
		Measurement of impedance in the range between 100mΩ to 2GΩ or better with a broad frequency range.
2	Measurement frequency	20 Hz to 50MHz and upgradable
3	Frequency resolution	1mHz or better
4	Basic Accuracy	±0.05% or better

5	Measurement parameters	Capacitance (C), Inductance (L), Resistance (R), Reactance (X), Conductance (G), Susceptance (B), Dissipation Factor (D), Quality Factor (Q), Impedance (Z), Admittance (Y), Phase Angle ( $\emptyset$ ), Permittivity, Permeability, Polar & complex plots and additional measurements parameters are preferable.
6	Measurement modes	LCR mode, Analyzer mode, Continuous measurement mode, Equivalent circuit analysis functions
7	Measurement circuit	Series/Parallel
8	Correction	Open Circuit/ Short Circuit/Load Correction
9	Test signal	RmsVoltage: 10 mV to 1V or better
		Voltage resolution: 1 mV or better
		Current: 200 $\mu$ A - 20mA
		Current Resolution: 20 $\mu$ A or better
10	DC bias voltage & resolution	0 to $\pm$ 40 V & 1mV
11	DC bias current & resolution	0 to $\pm$ 100 mA & 40 $\mu$ A or better
12	No. of Measurement Points	Upto 1600 or better in one sweep analysis.
13	Range selection	Auto /Manual (both)
14	Sweep Parameters	Frequency, signal voltage, signal current, DC bias voltage, DC bias current
15	Sweep type	Linear frequency, log frequency, OSC level (voltage, current), DC bias (voltage, current), log DC bias (voltage, current)
16	Display	Colour Touch screen, Instrument should be able connect to computer display.
17	Interfaces	GPIB , LAN, USB, RS232 should be available
18	Marker search	Maximum value, minimum value, multi-peak, multi-target, peak, peak left, peak right, target, target left, target right, and width parameters with user defined bandwidth values
		<ol style="list-style-type: none"> <li>1. 4 terminal</li> <li>2. Materials test equipment</li> <li>3. Dielectric probe kit</li> <li>4. Liquids fixture with BNC converter</li> </ol>

19	Test fixtures	5. SMD test fixture compatible upto 120 MHz		
		6. Bottom Electrode SMD Test Fixture		
		7. Axial & radial test fixture		
		8. SMD Tweezers test fixture		
		9. Kelvin Clip-type test fixture		
		10. Lead type test fixture		
		11. Component fixture		
		12. DIP Test Fixture		
		13. high temperature component test fixture		
		14. Magnetic test fixtures		
		20	High temperature option with variable temperature	1. High temperature -500 °C
				2. High temperature holder for bulk samples
				3. PID temperature controller
				4. Data logging software: Parameter Vs Frequency, Parameter Vs Temperature
5. Interfaced: RS232				
6. Interfacing Cables: BNC coaxial cables should be provided along with the setup				
21	Accessories	Supplier should add essential accessories in the quote		
22	Optional	4 terminal Impedance probe kit		
23	Connectors	Require 4 (four) BNC cable to BNC cable connection		
		Converter 4 to1 and 2		
24	Power supply	220 to 240 V AC, 50/60 Hz		
25	Operation Environment	<p>Temperature: 10 ~ 40 or higher</p> <p>≤</p> <p>Humidity: 90%</p>		

26	Manual Accessories	Power cord , Instruction manual , PC communication instruction manual (CD-R)
27	Software	Suitable software for PC Equivalent circuit analysis with licence
28	Personal Computer (PC)	A Personal Computer (PC) with 10 <sup>th</sup> generation i7 processor, 2Terabyte HDD. Dedicated graphics card, Bluetooth Wi-fi, 21" LCD TFT Screen should be quoted. Software must be provided in CDs/DVDs. The scope of supply also includes a good (reputed make, please give the details) Colour Laserjet Printer having a resolution of 1200 x 1200 dpi or better.  Authorised MS Office (Latest version) should be included in the quote
29	Calibration	<ul style="list-style-type: none"> <li>• Provide trimming standards for calibration</li> <li>• The Impedance Analyzer should be pre-calibrated</li> <li>• The OEM provide calibration certificate.</li> </ul>
30	Compatibility	Instrument should be compatible with high Temperature and Low temperature systems
31	Warranty	3 Year
32	Maintenance	The system should come with an initial annual maintenance cover (AMC) of minimum three year after warranty.

### 2020-21/04/08\_Laboratory TOC Analyzer

Sl. No.	System/parameter	Specifications
1	Instrument	TOC analyzer must be capable of measuring total organic carbon (TOC), Total carbon (TC), total inorganic carbon (IC), non-purgeable organic carbon, volatile organic carbon, total nitrogen (TN) in aqueous and solid samples
2	Modules	I. TOC Analyzer II. Total Nitrogen module



		III. Solid sample module
3	Operating principles	I. Catalytic combustion at high temperature ( about 670 Degree Celcius or better II. It should be PC controlled III. Nondispersive IR analyzer
4	Measuring range	I. TC: 5 µg (or less) to 3, 000 mg/L or better II. IC: 5 µg (or less) to 3,500 mg //L or better III. Volatile organic carbon: 5 µg (or less) to 500 mg/L IV. Measurement accuracy: 1.5%CV (max) or better for entire range V. Measuring time: 3 to 4 minutes VI. Sample injection: Sample injection using microliter syringe manually as well as with autosampler VII. Sample injection volume: 10-20000 µl VIII. IC treatment: Automatic internal acidification and sparing IX. Dilution rate: 2x to 50 x X. Dilution accuracy: ±2% or better XI. Carrier gas: High purity air XII. Supply pressure: 200±10 kPa XIII. Gas consumption: 200 ml/min or less
5	Nitrogen module	I. Chemiluminescence measurement method II. Measuring range: 0-10,000 mg/L III. Detection limit: 5 µg/L or better IV. Accuracy: 3%CV or better V. Measurement time: about 3 to 5 min VI. Ozone gas source: Air
6	Solid sample module	I. Measurement principle: Combustion catalytic oxidation (TC), Acidification (IC) II. TC furnace temperature: 900 ° Celcius (operating temperature) III. Measurements: TC, IC, TOC IV. Measuring range: TC: 0.1 to 30 mg carbon; IC: 0.1 to 20 mg Carbon V. Sample size: 1 g or less VI. Analysis time: 5-6 minutes VII. Carrier gas: High Purity Oxygen gas VIII. Oxygen Gas consumption rate: 550 ml/min or less IX. Soild sample combustion unit

7	PC	I. A Branded PC with Intel core i3 10th generation with all necessary licence softwares for OS, Instruments etc.
		II. Minimum 4 USB ports, 1 TB SSD; RAM 8 GB; OS Window 10 professional; 2 GB grraphic card; TFT ICD screen
		III. Shold have all data acquisition capabilities
8	Others	I. Should quote and provide all other accessories required clearly for operating instrumnt in full capacity
		II. Should provide standard samples for aqueous and solid for IC, TOC, TC, Nitrogen and volatile carbon.
		III. Coagulation bath temp. max upto 80 °C with temperature control
		IV. Should provide NIST tracable calibration certificates for standards
		V. Should provide details of catalyst life time in termas of sample analysis
		VII. Should provide sufficient catalyst to operate instrument for at least two year
		VIII. Should provide sample preparation kit with sample filtration
		IX. Should provide required Air and gas cylinders with regulators
9	Standards	Should meet ASTM D8083-16 and ASTM D7573 requirements
10	Other provisions	Each module should capable of automatic setting of optimal measurement conitions; Automatic selection of the optimal calibration curve; and Automatic changing of conditions and re-measuremnts of ou-of-range samples

**2020-21/04/09\_Lab-Scale Twin Screw Extruder for 3D printing filament**

Sl. No.	System/parameter	Specifications
1	Extruder type	Parallel, Co-Rotating, Lab scale Twin Screw Extruder. Filament measuring and controlled unit with closed loop for precise adjustment of the 3D filament diameter.
2	Application	Extrusion of polymer monofilament for 3D printing.

3	Barrel	<ul style="list-style-type: none"> <li>L/D ratio: 40:1 or as suitable for manufacture and recipe development of thermoplastic and engineering polymers.</li> <li>The system must have an atmospheric vent facility with proper adaptor.</li> </ul>
4	Screw Diameter	<ul style="list-style-type: none"> <li>Minimum 11 mm</li> </ul>
5	Screw speed	10 to 1000 rpm
6	Torque per shaft	Minimum 6 Nm, constant torque with safety monitor
7	Ratio screw outer dia./ inner dia.	1.72 or more to allow feeding of fluffy materials
8	Pressure	100 bar or Higher with safety monitor
9	Temperature	Room temperature to 450°C
10	Feed zone	Permanently water cooled with refrigerated chiller to be included
11	Heating zones	With minimum of 5 zones with electrical heated (optional water cooling should be quoted)
12	Extruder control	<p>Extruder control is via an integral colour touch screen for monitoring of following parameters:</p> <ul style="list-style-type: none"> <li>Extruder speed (rpm)</li> <li>Extruder torque (%)</li> <li>Barrel temperatures (Deg. C)</li> <li>Pressure (bar)</li> <li>Volumetric/Gravimetric feeder speed (%)</li> <li>Able to monitor the filament dia.</li> </ul>
13	Feeding systems	<p>Minimum 2 nos. feeding zone - One for polymer and other for powders/fillers/Additives with the following requirement:</p> <p>Volumetric/Gravimetric Single Screw Feeders for polymer with feed funnel and hopper (minimum volume of 1.3 litres or more).</p> <p>Safety grid feeder which controls by main control panel with safety interlocked feeder support.</p> <ul style="list-style-type: none"> <li>Feeder for base polymer: Single screw feeder to feed powder or pellets into the main feeding or a secondary feeding port.</li> </ul>

		<ul style="list-style-type: none"> <li>Feeder for feeding powders: Twin Lead Feeder screw with core for minimal output. Suitable for powder materials.</li> </ul>
14	The extruder should be supplied with 3D strand die	<p>Strand diameter can be easily altered using various set of die inserts (0.5, 1, 1.5, 1.75, 2, 2.5, 3 mm).</p> <p>Allows quick change of the die diameter. Should contains a set of threaded die nozzle (0.5, 1, 1.5, 1.75, 2, 2.5, 3 mm).</p>
15	Melt pump	<p>The extruder must be supplied with a melt pump to eliminate the pulsation in the polymer melt flow. The melt pump should be fully compatible with the extruder with the flowing specifications:</p> <ul style="list-style-type: none"> <li>Pump head volume: 0.6 cm<sup>3</sup>/rev or better</li> <li>Pump speed: 0.1 to 50 rpm or more</li> <li>Heating zones: 1 (1 internal / 1 external)</li> <li>Temperature: Room temperature to 450 °C</li> <li>Pressure: 500 bar or better</li> </ul>
16	Post Extrusion systems	<p>The extruder should be supplied with post extrusion accessories like water bath, spooler and laser diameter measuring system to take up, measure and wind up the strand for 3 D printing.</p> <p>The spooler must be compatible with extruder die height and must have the following specifications:</p> <ul style="list-style-type: none"> <li>Adjustable line speed with self-adjusting compensation for spool diameter.</li> <li>Filament distribution traverse with settable travel to compensate spool width.</li> <li>Line speed: 0.5 -15 m/min or more</li> <li>Filament diameter: 0.5 - 3 mm</li> <li>Mas spool width: 100mm or better</li> </ul>

		<p>Laser diameter measuring system:</p> <ul style="list-style-type: none"> <li>• Measurement range: 0.1-5mm or better</li> <li>• Measurement accuracy: <math>\pm 0.002</math>mm or better</li> <li>• Resolution: 0.001mm</li> <li>• Should be capable of identifying the variation of diameter while extruding for maintaining the desired diameter</li> <li>• Fully automatic closed loop control technology for precise control of filament diameter.</li> </ul>
17	Vacuum system	Compatible vacuum system to be attached with extruder
18	Chiller	Refrigerated circulator chiller to cool and maintain the extruder zones temperature
19	Other accessories as a part of supply	<ul style="list-style-type: none"> <li>• Extra Screw element set: To change the screw profile and should contain the following: <ul style="list-style-type: none"> <li>4 x Feed Screw, 1 L/D</li> <li>2 x Feed Screw, 0.5 L/D</li> <li>2 x Reverse Feed Screw, 0.5 L/D</li> <li>8 x Mixing Element 0°, 0.25 L/D</li> <li>8 x Mixing Element 90°, 0.25 L/D</li> </ul> </li> <li>Anti-Seize paste</li> <li>• High Volume Feed Screws: A set of asymmetrical shaped geometry feed screws to increase free volume and to allow feeding commercial pellet sizes (=4 mm) into the extruder.</li> </ul>
20	Essential spares/ Accessories	<p>Tool box</p> <p>Purging kit</p> <p>Compressor as per the requirement Spare should be available for smooth running of instrument for minimum of 02years.</p>
		Compatible to Windows 10 or higher

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

**2020-21/04/10\_ Modulated Differential Scanning Calorimeter (MDSC)with auto-sampler**

Sl. No.	System/parameter	Specifications
		Measurement of the following properties of polymers, rubbers, elastomers, etc.

1	Purpose	<ul style="list-style-type: none"> <li>Measures heat absorbed or released by a sample as a function of time, temperature and environment</li> </ul>
		<ul style="list-style-type: none"> <li>Glass transition temperature (<math>T_g</math>)</li> </ul>
		<ul style="list-style-type: none"> <li>Melting temperature (<math>T_m</math>),</li> </ul>
		<ul style="list-style-type: none"> <li>Crystallization temperature (<math>T_c</math>)</li> </ul>
		<ul style="list-style-type: none"> <li>% of crystallinity,</li> </ul>
		<ul style="list-style-type: none"> <li>Curing temperature</li> </ul>
		<ul style="list-style-type: none"> <li>Degree of cure</li> </ul>
		<ul style="list-style-type: none"> <li>Purity</li> </ul>
		<ul style="list-style-type: none"> <li>Activation energy</li> </ul>
		<ul style="list-style-type: none"> <li>Heat of enthalpy</li> </ul>
		<ul style="list-style-type: none"> <li>Heat of fusion</li> </ul>
		<ul style="list-style-type: none"> <li>Kinetic studies</li> </ul>
		<ul style="list-style-type: none"> <li>Thermal stability</li> </ul>
		<ul style="list-style-type: none"> <li>Oxidation/decomposition</li> </ul>
2	Reference Standard	ASTM D 3417-99, ASTM D 3418-15, ASTM E 1356-08(2014), ISO 11357-1:2016, ASTM-D 3895-14
3	Temperature Range	Temperature range from $-90^{\circ}\text{C}$ to $725^{\circ}\text{C}$ or higher.
		The sub ambient temperature should be achieved by using 2 stage refrigerated intra-cooler type of system (not by liquid nitrogen). The intra-cooler should have the ability to cool the DSC Cell from $500^{\circ}\text{C}$ to $25^{\circ}\text{C}$ in around 7 minutes or less.
		Sample cell must be able to heat to a temperature higher than $700^{\circ}\text{C}$ for the study of decomposition of contaminants if required.
4	Temperature Accuracy	$\pm 0.1^{\circ}\text{C}$ or better
5	Temperature Precision	$\pm 0.05^{\circ}\text{C}$ or better
6	Heating Rate	$0.01^{\circ}\text{C}/\text{min}$ to $200^{\circ}\text{C}/\text{min}$
7	Cooling Rate	$0.01^{\circ}\text{C}/\text{min}$ to $100^{\circ}\text{C}/\text{min}$
8	Calorimeter Sensor	Ceramic Type or equivalent
9	Maximum Calorimetric Sensitivity	$0.2\ \mu\text{W}$

10	Calorimetric Precision (based on metal standard)	±0.05%
11	Dynamic Range	± 350 μW or better
12	Temperature Calibration	The instrument should be able to be calibrated with 5 points. Indium Should be supplied along with the instrument with CRM certificate.
13	Baseline Curvature (-50° to 300°C)	Less than 100 μW or better
14	Baseline Reproducibility	Less than 40 μW or better
15	Baseline Noise (max. peak to peak)	<1 μW or better
16	Measurement Atmosphere	Nitrogen and Oxygen gas
17	Provision for cooling	One Mechanical cooling system with controlled cooling rate should be provided along with the instrument with min 05 years of warranty..
18	Control system	Gas flow correction and controller for accessories mass, flow rate
19	Auto-sampler	The instrument should be integrated with min of 40 position autosampler. Sample and reference pans may be assigned to any combination of the available positions.
		<ul style="list-style-type: none"> <li>Operating software and analysis software shall be user friendly and shall be running on windows 7 version or higher.</li> <li>Analysis software shall have the provision to smoothen to evaluate peak temperature, onset temperature, glass transition temperature, melting temperature, 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.</li> <li>The software shall have the provision to view total heat flow, modulated heat flow, total heat capacity signals in real time during experiment.</li> </ul>



20	Data analysis software	<ul style="list-style-type: none"> <li>• Software for kinetic studies for single and multiple steps through non-linear regression</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• 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.</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• 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.</li> </ul> <hr/> <ul style="list-style-type: none"> <li>• 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.</li> </ul>
21	Software Compatibility and functions	<p>Compatible to Windows 7 or higher OS (32 and 64 bit) and should have the capabilities to heating rate, temperature setting, etc.</p> <hr/> <p>capable of collecting data on heat flow, heat capacity enthalpy change, Cp, Tg, Tm, Tc, peak area, peak onset, etc.</p>
22	Personal Computer (PC)	<p>A Personal Computer (PC) with 10<sup>th</sup> generation i7 processor, 2Tb HDD. Dedicated graphics card, Bluetooth Wifi, 21" LCD TFT Screen should be quoted. Software must be provided in DVDs. The scope of supply also includes a good (reputed make, please give the details) Colour Laserjet Printer having a resolution of 1200 x 1200 dpi or better.</p>

		Authorised MS Office (Latest version) should be included in the quote
23	Accessories	<p>DSC shall include</p> <ul style="list-style-type: none"> <li>• 10 nos. of Platinum pans, 10 nos. of Graphite pans, and 500 nos. of Hermetic Aluminum sample pan with lids.</li> <li>• CRM such as Indium, Cobalt, Tin, Sapphire, Adamantine with its traceability certificate and calibration certificate.</li> <li>• Tubing fittings</li> <li>• Moisture tap and filters</li> <li>• Sample crimping kit.</li> </ul>
24	Power Requirement	100-240 Volt, 50/60 Hz
25	Others	<ul style="list-style-type: none"> <li>• Modulated DSC shall have the ability to apply sinusoidal temperature wave to sample by amplitude and frequency.</li> <li>• Modulated DSC shall include the ability to perform quasi-isothermal experiments i.e. holding isothermal with a small temperature modulation.</li> <li>• 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.</li> <li>• DSC shall allow for the direct measurement of specific heat CP i.e. in one single scan.</li> </ul>
26	Other Mandatory Items	<p>While supplying the Machines, the supplier should also provide the following items apart from above:</p> <ul style="list-style-type: none"> <li>• Hard/soft copies of Operational &amp; Service Manual- 01 Set.</li> <li>• Machine should come with all other essential accessories &amp; spares required for installation, commissioning &amp; Operation.</li> </ul>

27	Warranty.	Min 03 years.
28	Maintenance	The system should come with an initial annual maintenance cover (AMC) of minimum 03 years after completion of warranty period.

### 2020-21/04/11\_ Multi Jet Fusion

Sl. No.	Description	Specification
1	Make	Bidder to specify
2	Model	Bidder to specify
3	Technology	An open architecture 3-D Polymer Additive Manufacturing System based on non-laser Material Fusion Technology having capability to transform part properties voxel by voxel.
4	Applications	The Machine will be used for Direct production of concept models, functional prototypes, strong mechanical parts for end use applications, patterns for sand casting etc.,
		The machine should be able to process varieties of engineering polymers to enable rigid and flexible parts to be produced.
		Printed part should be isotropic & watertight having density at least 99 % or better.
<b>5</b>	<b>Processing Unit</b>	
5.1	Building volume	Minimum built volume 350 mm x 280 mm x 350 mm (bigger build volume is preferred).
5.2	Layer thickness	0.08 – 0.1 mm or better
5.3	Build speed	5000 cm <sup>3</sup> /hr or better
5.4	Accuracy	0.2 mm/100mm or better
5.5	Min wall thickness / scanning line	0.4mm or Better
5.6	Resolution	1200 dpi or better
5.7	Machine Control	Advanced latest control system for effective control and printing
5.8	Thermal Control and Real time temperature Monitor & correction System.	To monitor the build temperatures throughout the build volume and calibrate automatically after each build layer. The mechanism employed to achieve this need to be explained in detail in the bid.

5.9	Effective Part Manufacturing Criteria	Supplied system should have fully Automated Mixing, Sieving, and Loading; with fast cooling option of Build Unit as a separate unit and the printing unit should be free from any material handling.
		Additional Material processing unit with fast cooling option & build unit for handling different material & enhanced productivity should be quoted.
5.10	Powder Recycling and Handling	Fully automatic system, Processing Station with Fast Cooling of Build unit to be provided.
5.11	Filter System	The system should have a filter which can remove both big and fine condensates. The life of each filter to be defined by the manufacture.
5.12	Parameter set module	Supplier should supply proven parameters for the above materials with clear documentation and statistics of the mechanical properties as build and under heat treatment conditions.
5.13	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.
<b>6</b>	<b>Material</b>	
6.1	Material options	Licence for wide variety of material option and capable to use all type of materials such as Nylon 11, Nylon 12, glass filled Nylon, TPU and new materials.
		The material should be UL 94 certified for flammability & suitable for use in electrical/ electronic end use products
		Parts made of the material should be IP 67 certified, suitable to print enclosures for outdoor usage.
6.2	Powder material	Supply 125 kg each of Nylon 11 and PP material with required other consumables and accessories.
<b>7</b>	<b>Software</b>	

	Licensing	perpetual for all softwares
7.1	Process Software	To control the building process and ergonomic operating interface of the touch screen. The process software should be able to work closely with the internal production and generate statistical QA reports which are preferred to subjective method of reporting.
7.2	Slicing and data editing software	Complete module for conversion of part data in the STL format and optimization of layer data.
7.3	Software feature	The machine should have feature of adding the parts in the running build job without interrupting the build.
7.4	Process control desktop software	To prepare build job independent from the machine processor.
7.5	Control and reporting software	Suitable software for controlling and reporting RP system. The system should also automatically generate the following for documentation General information of the build job Illustration of part placement on the build platform Process information of parameters and time Sensor data for temperature, pressure
<b>8</b>	<b>Essential Accessories</b>	
8.1	Workstation with accessories	Bidder should provide Suitable OEM computer system handling large size stl data with complete accessories for slicing and control building process.
8.2	Vacuum Cleaner	Bidder should provide Suitable Vacuum Cleaner
8.3	Bead Blasting	Bidder should provide Suitable Bead Blasting with air blasting capabilities for smooth surface finish
8.4	Online UPS	Bidder should provide Suitable UPS with minimum 60 minutes backup power for the machine.
8.5	De-humidifier	Bidder should provide as per the requirement
8.6	Compressor with dryer (Silent operation)	Bidder should provide as per the requirement
8.7	Electrical Lifting and handling truck	Bidder should provide Suitable system if necessary for the machine
8.8	Break out Tool Kit	Bidder should provide Standard tools/kits for startup, removal of parts and cleaning (list to be attached).

8.9	Maintenance Kit	Bidder should provide Required spares like filters, rubber blade, lamps, gloves, Mask, Safety Goggles etc. should be supplied
8.10	Post-processing unit	Bidder should provide suitable dye finishing unit
<b>9</b>	<b>Other accessories</b>	Bidder should provide with details
9.1	Materialise Software	Bidder should provide suitable and available all modules of Materialise software for this 3D printer.
<b>10</b>	<b>Any other accessories if available/required</b>	Necessary/Optional accessories and spares, if required for running the machine smoothly, bidder to specify with details and quote.
<b>11</b>	<b>Other essential requirements</b>	
11.1	Safety	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.
11.2	Other Conditions	The bidder must have supplied at least 3 such machines of similar capacities with in India including OEM Installations in the past 3-4 years. A satisfactory performance certificate from those users may be solicited if needed. Bidder should submit complete contact details.  Manufacturer of the supplied equipment must be ISO/ CE/FDA approved  Bidder must submit Authorization letter form OEM of Printer, materials and software
11.3	Scope of supply	Bidder should submit complete scope of supply (Machine, standard accessories, Other Accessories etc with make model) in the technical bid. Bidder should supply complete start up package including material necessary to prove the machine and provide training.
<b>12</b>	<b>Installation, Commissioning and Training</b>	

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	<p>Minimum of 5 days training for five persons which includes basic &amp; advanced level training. Training content and plan to be submitted. Training faculty must have adequate experience in this field.</p> <p>The vendor should supply the necessary manuals such as</p> <ul style="list-style-type: none"> <li>· Software instruction</li> <li>· Maintenance and trouble manual</li> <li>· Training</li> <li>· Installation and Commissioning</li> <li>· Handling of accessories</li> <li>· Software key (if any)</li> </ul>
12.4	Technical support and service	<p>Manufacturer should have established after sales &amp; service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 24 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>
12.5	Annual Comprehensive Maintenance Contract (ACMC)	<p>Vendor should quote for Annual Comprehensive Maintenance Contract separately for the whole system and accessories supplied after the completion of performance warranty period. Supplier has to provide service support within 24 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.</p>

**2020-21/04/12\_Oxygen Induction Time Tester**

<b>S. No</b>	<b>Items</b>	<b>Specification</b>
1	Standards	IS 4984 and ASTM D 3895
2	Temperature Range	Ambient to 300°C or better
3	Resolution	0.1°C
4	Accuracy	0.001°C or better
5	Ramp rate	20°C/min. for test & 2°C/min for calibration
6	Controller	Microprocessor based L.C.D. display for process temperature, PID Controller with temperature range up to 300°C or better
7	Maximum Test time	0 to 250 or better
8	Gas flow control	Through gas regulator on the cylinder and rotameters on the machine
9	Accessories	200 or more Aluminium Pans, Copper pan 100 nos or more, Indium and/or Tin for calibration, Gas regulators, Specimen holder
10	Cooling System	To be specified
11	System requirements	The windows based software to interface the computer, Data entry through software, PC connectivity to be specified Graphical data reports to be printed through software

**2020-21/04/13\_Stereolithographic Apparatus (SLA)**

<b>1</b>	<b>Processing Unit</b>	
1.1	Make	Bidder to specify
1.2	Model	Bidder to specify
1.3	Technology	Liquid based additive manufacturing system based on Stereolithography process
1.4	Minimum Build Volume (X, Y, Z)	600 mm x 600 mm x 400 mm or larger with XY axis control
1.5	Resin Vat	Resin VAT with in-built heating module and inter-changeable VAT mechanism
1.6	Process Chamber	Automatic resin level sensor, resin heating and re-coater system with solid platform
1.7	Building Platform	Stainless steel, perforated and reinforced platforms
1.8	Positioning	Precision positioning on all axis



1.9	Recoating System	Automatic, active recoater blade with volume status monitor and control
		Minimum layer thickness 0.05 to 0.25 mm or better
		Self leveling and self correcting of the resin inside the recoater
1.10	Laser	One or two Diode pumped Solid state laser Nd:YVO4 with 355nm wave length or Better/equivalent
		Laser power 3000mW or better/Suitable for the machine
1.12	System Monitor and control Unit	Windows based Industrial Computer system and printer OS
1.13	Scanning Strategy	Should support variable beam ( laser facula size of 0.08 mm to 0.8 mm) for fast built with different facula size for contour and infill section to achive better surface quality and faster productivity. The scanning speed should be 6 m/s to 10 m/s or better.
1.14	XY Resolution	3800 DPI or 150 $\mu$ or better
1.15	Accuracy	0.1 mm for part size of 100 mm or 0.1% of part size excess of 100 mm size in xy and z axis
1.16	Layer resoution	25 micron
<b>2</b>	<b>Material</b>	
2.1	Material	Must have OEM and authorized materials from suppliers of repute, must have the ability to fabricate parts using rigid & durable (ABS like), Transparent and suitable for investment casting (PC like), durable and other materials (High Temperature, Flexible, etc.). vendor should supply one interchangeable full VAT with PC like materils along with the printing system. Also, Cost of per kg of each material (Rigid, high temperature, medical, PP like flexible and casting applications etc.). should be quoted in the remarks column
		Machine should have the provision of testing materials developed by the user and professional guidance should be given to adhere to the system compatibility and configuration

		Bidder should also supply proven parameters for all the suitable materials with clear documentation and statistics of the mechanical properties with respect to build orientation and layer thickness.
2.2	Customised material guidance	Machine should have the provision of testing materials developed by the user and professional guidance should be given to adhere to the system compatibility and configuration
2.3	Data sheet (MDS)	MSDS or material data sheet must be submitted for materials to be submitted
<b>3</b>	<b>Software</b>	
3.1	System control Software	Capable for 3D view, manage and printing of Jobs and must have OEM partnership with the software company for future support and upgrades. OEM certificate must be submitted along with the supporting document
3.2	Part Preparation and machine control Software	Complete module for conversion of part data in the STL format and optimization of layer data.
3.3	Parameter editor	The Printer software must support an open architecture to allow modification and other process parameters for all quoted or future materials.
3.4	License	License must be perpetual and the vendor should provide software Licence for all the materials which can be printed by quoted machine
<b>4</b>	<b>Essential Accessories</b>	
4.1	Curing Chamber	Suitable post curing chamber accommodating full size printed part
4.2	Interchangeable Material tray	Bidder should quote the price for additional resin VAT (1 Full and 2 half) with lifting & Handling system and accessories
4.3	Sand Blaster	Bidder should provide suitable for the SLA
4.4	Support removal	Bidder should provide accessories/ tools for manual support removal of parts and cleaning
4.5	De-humidifier	Vendor should supply suitable de-humidifier to maintain room humidity level within suitable range for machine operation.

4.6	Online UPS	Vendor should supply Branded UPS with minimum 60 minutes power backup suitable for the machine and essential accessories. Should have built in safety to protect machine from voltage spikes and sudden surges.
4.7	Workstation with accessories	Bidder should supply suitable latest model workstation with complete accessories for handling large size STL data (Xeon Silver 4108 Processor or higher, Win 10 Pro, RAM: 128GB DDR4, NVIDIA Quadro P1000 4GB, 5 TB Hard Drive, Monitor, Keyboard, min. 3 Years Warranty)
4.8	Compressor	Bidder Should Provide branded compressor suitable for SLA
4.9	Tool kit	Vendor should supply standard tool kit for startup, removal of parts and cleaning (list to be attached).
4.10	Post processing accessories	Bidder should supply required post processing accessories including improvement of transparency in part printed with clear material.
<b>5</b>	<b>Additional Accessories</b>	
5.1	Design, Analysis & Optimisation software (Research Version & License must be perpetual) - <b>Bidder must quote AMC cost separately for each items</b>	Solid Works - Design complete module Materialise software for additive manufacturing - SLA and SLS complete modules and e-Stage modules for plastics and metals, 3 Matic Design, Lattice, Raw mesh, Texturing, CAD link.
5.2	Any other accessories required	Vendor should supply all the other accessories, material transport trolleys / carts and spares required for effective and better utilization of machine. All the required accessories should be listed and quoted separately.
<b>6</b>	<b>Other essential requirements</b>	
6.1	Safety	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.

6.2	Other Conditions	The bidder must have supplied at least 3 such machines of similar capacities with in India including OEM Installations in the past. A satisfactory performance certificate from those users may be solicited if needed. Bidder should submit complete contact details.
		Manufacturer of the supplied equipment must be ISO/ CE/FDA approved
		Bidder must submit Authorization letter form OEM of Printer, materials and software
6.3	Scope of supply	Bidder should submit complete scope of supply (Machine, standard accessories, Optional Accessories etc with make model) in the technical bid. Bidder should supply complete start up package including material necessary to prove the machine and provide training.
<b>7</b>	<b>Installation, Commissioning and Training</b>	
7.1	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.
7.2	Training and documentation	<p>Minimum of 5 days training for five persons which includes basic &amp; advanced level training. Training content and plan to be submitted. Training faculty must have adequate experience in this field.</p> <p>The vendor should supply the necessary manuals such as</p> <ul style="list-style-type: none"> <li>· Software instruction</li> <li>· Maintenance and trouble manual</li> <li>· Training</li> <li>· Installation and Commissioning</li> <li>· Handling of accessories</li> <li>· Software key (if any)</li> </ul>

7.3	Technical support and service	<p>Manufacturer should have established after sales &amp; service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 24 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>
7.4	Annual Comprehensive Maintenance Contract (ACMC)	<p>Vendor should quote for Annual Comprehensive Maintenance Contract separately for the whole system and accessories supplied after the completion of performance warranty period. Supplier has to provide service support within 24 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.</p>

### 2020-21/04/14\_Torque Rheometer

S. No	Items	Specification
1	Applications	<p>Machine should be modular (mixer &amp; extruders attached to same drive) and be capable to study the following properties,</p> <p>Viscosity, Flow behaviour, Torque</p> <p>Twin screw compounding and recycling of polymers</p> <p>Blend ratio</p> <p>Extrusion and injection moulding processability</p> <p>Influence of the screw design on the viscosity</p>
2	Temperature Range	ambient to 400°C or more
3	Torque Range	150 Nm higher
4	Rotor Type	Roller Rotors
5	Heating zones	4 or more
6	Feed section	Air and water cooled
7	Temperature controller	Electrical
8	Screws	Single and Twin Screws

9	Screw speed (rpm)	0-200 or higher
10	Software	Suitable software for control / measurable parameters (torque, speed, temperature and time) evaluation, and materials response to be provided. Compatible to windows 10
11	Overload protection	Electrical cut-off to be provided
12	Feeding system	Manual and Pneumatic
13	Peripheral devices	Batch Mixer
		Extrudate cooling baths
		Blown film unit
		Feeder
		Pelletizer
14	Heating & Cooling systems	Integrated heating & cooling systems to be provided
15	Dies	Capable for producing profiles like blown films, rods and multi-strands, wires, filaments
16	Batch mixing Features	Bidder to specify
17	Accessories	Please quote any other essential accessories mandatory to meet the requirements
		Optional accessories to be quoted separately
18	Work station ( computer)	i7 8GB 21" 1Tb branded workstation as per the requirement of software for equipment
19	Operating system	Windows 10 original

### 2020-21/04/15\_Xenon Arc Weatherometer

S.No	Items	Specification
1	Chamber Type	Rotating rack
2	Specimen Capacity (nos.)	100+ (Tensile/Impact samples of ASTM/ISO standards)
3	Specimen Orientation (measured from horizontal) (°)	90
4	Exposure Area (cm <sup>2</sup> )	10,000+
5	Rack Type	3 tier or more

6	Specimen holder	Atleast 2 additional sets of sample holders (apart from the tensile/impact specimen holder mentioned above) should be provided to accommodate different types of samples such as rigid plastics, plastics films, textiles, paper/cardboard, foam, rubber sheet, leather, photovoltaics etc. Chamber should be capable of accommodating 3D products.
7	Standards	Should comply with all available ASTM, ISO, MIL, JIS and GB standards related to Plastics, Fibers, Textiles, Elastomers/Rubbers, Latex, Adhesives, Sealants, Coatings, Paints, Printing Inks, Colorants, Paper/Cardboard, Foam, Leather and Polymer/inorganic hybrid composites
8	Irradiation source & Wattage	Xenon arc lamp (5000- 12000 W)
9	Typical Average Lamp Life (Hours)	Above 5000 (for normal irradiance of 40-70 W/m <sup>2</sup> )
10	Light Filters and Irradiance Control	Suitable Interchangeable filters (for indoor and outdoor applications). Automatic Microcomputer for narrow band (340 nm/420 nm), broad band (300-400 nm) or illuminance control/LUX (400-750 nm). Vendor to quote all available combinations of filters.
11	Irradiance Range (W/m <sup>2</sup> )	0.2 - 160
12	Humidity Control	Automatic Proportional control with Direct RH Sensor
15	Temperature Control (°C)	Automatic smart control system
18	Chamber Temp (°C)	Light Cycle (any filter)- 30-70 °C, Dark Cycle- 15-60 °C through air circulation
20	Compressed Air	Should be fulfilling the requirement of all the specified standards.
21	Xenon lamp system	Calibrated lamp with cooling system. Calibration certificate with traceability should be provided
23	Blower Speed Control	Automatic
24	<b>Software and Display</b>	
	Pre-Programmed Test Methods	minimum of 10 pre-programmed standard test methods
	Display	Color display monitor with all control features
	Data storage features	Sufficient data storage space
		Provisions to take snapshot during test

		Provision for connection with a workstation to be provided
	Programmable controls	Setting black panel temperature, relative humidity, specimen chamber temperature
25	Test countdown	Automatic w.r.t time or radiant exposure
26	Water filtering system	System should be capable of filtering water to a high purity level (resistivity > 1 mega ohms.cm). Should be equipped with automatic water indicator and alarm system.
27	Compressor	Suitable compressor for smooth running of the equipment
28	Radiometer	To measure radiant flux for self calibration to be provided (Calibration certificate with traceability should be provided)
29	Data output	Ethernet or USB port
30	Dust filter type	Air Intake
31	Essential Accessories	Atleast 3 different sets of sample holders
		2 spare xenon lamps
		Leg extensions
		Xenon lamp cooling system
		Chamber lock
		Filter lantern
32	Workstation	Latest Windows based, Reputed Branded Computer with B/w Laser Jet Printer
33	Installation requirements	State space required and condition of floor and any other requirement for installation of the machine/ equipment.
34	Installation & Training	Minimum of 2 days training for atleast three technicians
35	Manufacturer's credential	Should have sizable installations of same model worldwide and at least two same or similar model in India.
36	References	Tenderer shall give provide contact details of existing customers having such supply in India.
37	Safety requirements	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.



38	Spares and consumables	Tender shall include details of list of all essential spares and consumables along with quote.
39	Price list of spares and consumables	Price list of each material with minimum quantity, spares and consumables are to be quoted.
	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.
40	Tools and accessories	Appropriate tool box/kit for routine maintenance to be provided with the equipment
		All documents (i.e. operating and service manuals, drawings etc.) and original softwares relevant to the instrument and its accessories should be provided
41	Scope of supply	Tenderer will supply complete start up package necessary to prove the machine and provide training. List for scope of supply to be submitted.