Technical Specification For Tender No. 2022-23/06 Released Government E- Marketing (GeM Portal)

Polymerization Reactor			
Sl. No.	**Specification**		
(A)	**Main setup:**		
	The detailed specifications for fabrication of the multiple polymerization reactor are as follows:		
1	No. of the High-pressure polymerisation reactors in one set up: 5 Nos		
2	**Two out of 5 Nos,** should be Teflon lined of 4 inches and have option for connecting condenser with the reactors to perform polycondensation polymerization reaction.		
3	Two dean stark receiver, spiral condensers, vacuum pump connector and fitting etc., each for condensation reaction (**referencefigure attached at the end of specification**).		
4	Reactor will be designed to work at the Negative pressure of 760 mm of Hg.		
5	Recirculating chiller (JULABO or equivalent): 1 Nos		
6	One high pressure two stage vacuum pump should be provided with the instrument.		
7	MOC of each reactor & wetted Parts: INC 600		
8	Max volume of each Reactor: 250 mL		
9	Max operating pressure: 150 bar (Gases: N_2, H_2, CO_2 and O_2)(Continuous safe working pressure should be 85% of the design pressure)		
10	Max operating temperature: 550 °C		
11	Furnace: High temperature ceramic band with sound insulation to reduce heat loss and increases heating rate.		

12	Each reactor with the separate control unit in single setup with programmable logic temperature controller, pressure indicator with overshoot alarm & RPM indicator.		
13	Overhead pack less magnetic stirrer with high torque for viscous liquids with 10-1500 RPM.		
14	Each reactor with one gas sampling point with high pressure needle valve & one liquid sample point with dip tube with high pressure needle valve and applicable for viscous liquids, also.		
15	One thermowell to measure the reaction temperature.		
16	Two Gas inlet port at the same time with high pressure & temperature needle valve.		
17	One cooling coil inside each reactor with quick release fittings.		
18	Common Auto-cooling system with water pump for forced cooling, SS tank & hose pipes for exothermic reaction & faster cooling.		
19	Gasket; Spiral wound graphite		
20	Locking Bracket: - SS 316 Split Type		
21	Complete unit will be skid mounted on the Aluminium extrusion frame with locking wheels.		
22	A 8.00 mm thick polycarbonate safety sheet in the Front of the reactor setup.		
(B)	**Optional accessories:**		
	Itemized Price for all items must be quoted for bid to be valid (Will be added in main system for identifying lowest price bid, however, they may not be ordered depending upon budget).		

1	Gas cylinders: Prices for gas cylinder for each of the following gases of 47 litre (water) capacity should be quoted separately: N_2, H_2, CO_2 and O_2 (47 litre each)		
2	High pressure regulator (double stage SS or better)		
3	Hydrogen gas generator		
©	**Installation and service**		
1	Free installation, demonstration, and training be provided by certified personnel at CIPET Chennai.		
2	No. of visits per year: 2. Preventive maintenance visits per year scheduled within 1st three months of each half year.		
3	All the High temperature & Pressure Needle Valves & Fittings will be of Swagelok make Only.		
4	Material test certificate is required for the material used in the fabrication along with the NDT certificate.		
5	Hydro test certificate of each reactor with max test pressure of 200 bar is required along with the material.		
6	FREE AMC for the period of three years for high pressure & temperature multi reactor setup.		
(D)	**Terms and conditions:**		
1	A list of consumables with rates should compulsory be attached.		
2	Vendors should supply a certificate of availability of all spare parts for a period of at least 10 years from the date of purchase of equipment.		
3	Price (for supply and installation at CIPET Chennai) should be quoted inclusive of all taxesand charges as applicable.		
4	Service engineer should respond call/email 24 within hours.		

Benchtop NMR Spectrometer		
Sl. No.	**Specification**	**Range / Value**
1	InstrumentType	It should be PulsedFourierTransformNMR Spectrometer
2	SamplePresentation	Standard5mmod,178mm(7”)longNMRtubes
3	MagnetType	Permanent,Cryogen-Free, should provide frequency to entire sample without tube movement.
4	Operatingfrequency	80 MHz or more
5	Probe	It should have Probe for 1H, 13C, 19F, 29Si, and 31P
6	1H 50% Linewidth	0.3Hz or better (Instrument software Shim test report along with 10% H2O in D2O or shim standard sample peak with resolution at 1H 50% Linewidth should be submitted)
7	1H 0.55% Linewidth	10Hz or better (Instrument software Shim test report along with 10% H2O in D2O or shim standard sample peak with resolution at 1H 0.55% Linewidth should be submitted)
8	1H 0.11% Linewidth	20Hz or better (Instrument software Shim test report along with 10% H2O in D2O or shim standard sample peak with resolution at 1H 0.11% Linewidth should be submitted)
9	Sensitivity (Signal:Noise)	It should offer 200:1 or better for 1% Ethyl Benzene, Measured in a single scan on the quartet of the CH2 group. (Spectra of standard sample with sensitivity >120:1 should be submitted as a proof)
10	Anomer Study option	Should have carbon 2D variant with NOE, APT for anomer configurations
11	Stray Field	Should be <2 G all around the system
12	LockType	External Hardware Lock should be Independent of the sample and No Deuterated solvent should be required
13	Solvent suppression	It should have Solvent Suppression Pulse Sequence
14	ProbeTuneandMatch	Should be Preset,nouserinterventionrequired
15	Shimming	Shimming should be fully automated. Shimming for each sample should not be required.

16	Experimental Protocols	It should perform following protocols with ease for all nuclei H, F, P, Si and C1- D (H, F, and C), 1-D Paramagnetic, 2-D COSY (Correlation Spectroscopy), 2-D TCOSY (Total Correlation Spectroscopy), 2-D JRES (Homonuclear J-Resolved Spectroscopy), 2D F – COSY (Correlation Spectroscopy), 2D F – JRES (J-Resolved Spectroscopy), 2D FH – COSY (Correlation Spectroscopy), Relaxation T1 and T2, Proton Pulse-Decoupled, DEPT (Distortionless Enhancement byPolarization Transfer), APT (Attached Proton Test), HETCOR (Heteronuclear Correlation Spectroscopy), HMBC (Heteronuclear Multiple Bond Correlation), HMQC (Heteronuclear Multiple-Quantum Correlation), HSQC (heteronuclear single quantum correlation) HSQC-ME (multiplicity-edited HSQC)
17	Operatingtemperature	20°C to 26°C
18	Software and Computer	Anappropriate (e.g MNOVA) Software with permanente licenseshould be offeredalongwiththesystem.
		i7 processor 10th generation, 16GB RAM, DVD - RW, 500 GB SSD, Windows 11 with lifetime licence, Latest microsoft Office professional, 27" LCD display, Wifi enabled or with better specifications along with a suitable laser printer
19	Accessories to be quoted and supplied along with machine / equipments:	1. Online reaction monitoring Kit- 01 No.
		2. NMR tube- 100 nos.
		4. Auto sampler-01 no.
		5. Maintenance kit-01 no.
	Non-technical conditions	
20	Warranty	03years warranty should be provided with continued software upgradationas and when released
		The duly authorized representative(s)/scientists of the CIPET shall have the right, before payment, to
		inspect the Goods either at the OEM stores/during manufacture, or at the Place(s) of Delivery. The Supplier shall provide all facilities for such inspection.

		Any inspection carriedout by representative(s) of the CIPET or any waiver thereof shall be without prejudice to otherprovisions of the Contract concerning obligations assumed by the Supplier, includingspecifications of the Goods.
21	Inspection and acceptance	Upon delivery and inspection of the Goods, the CIPET shall inspect the goods as soon aspossible and complete the Goods Receiving Document. Should any Goods fail to conform tothe technical specifications, codes and standards under the Contract, the CIPET may reject the
		Goods. The supplier shall, at no cost to the CIPET, replace the rejected Goods or,alternatively, rectify the non-conformity.
		In the case of Goods ordered on the basis of specifications or samples, the CIPET shall have theright to reject the Goods or any part thereof and terminate the Contract if the Goods do notconform to the specifications and/or samples. Nothing in this clause shall in any way release
		the Supplier from any warranty or other obligations under the Contract.
22	Installation and Training	Two personnel from should be given training at the OEM factory site. Onsite training (03 days) should also be provided to the staff after installation. The Supplier shall provide all facilities for such training programme.
		Complete set ofmanualsfortheoperationofequipmentshould be given.

BET Surface Area Analyzer		
Sl. No.	**Specification**	**Range / Value**

1	Applications:	Should capable of analyzing Surface area of solid and porous materials such as polymer materials, fibers, medicine/ pharmaceuticals, pigments, carbon black, ceramics, battery materials, catalysts, cosmetics,cement, Toner particles, separation membrane, semi-conductor, adsorbent, MOF, COF etc.
2	Analyses:	Single- and Multipoint BET (Brunauer, Emmett, and Teller) surface area, thickness, pore area distributions (BJH method), pore volume, and pore surface area Langmuir surface area, Temkin and Freundlich isotherm analyses
3	Measurement type	1. Surface area: BET, Langmuir, t-plot, BJH/DH, DR, DFT
		2. Mesopore size: NLDFT, BJH/DH, Kr thin film
		3. Micropore Size: NLDFT, QSDFT, SF, HK, MP method, DA, Monte Carlo
		4. Pore Volume: Gurvich, α-s, BJH/DH, DFT, DR
		5. Adsorption energy: Clausius-Clapeyron, DR
		6. Fractals: FHH, NK
		7. Catalyst parameters: Active (metal) area, dispersion, crystallite size
4	Analysis gases:	· Nitrogen (N_2), CO_2, He
		· System should compatible with other gases like Ar, H_2, O_2, CH_4or other non-corrosive gases
5	Station:	· Onenumber
		· The system should have provisions for onsite upgrade for an additional ONE more micropore analysis station
6	Measurement Principle	Volumetric (Constant volume gas adsorption method)
7	Surface area range:	0.01 m^2/gand above
8	Pore size distribution:	0.35 to 500 nm
9	Pore volume:	2×10^{-6} cc/g (liquid), 1×10^{-4} cc/g (STP)or lower and micropore volume accurately detectable within 0.0001 cc/g

10	Transducers	133 kPa (1000 mmHg); ± 0.25% of full scale or better
		1.33 kPa (10 mmHg); ± 0.5% of reading or better
		0.0133 kPa (10 mmHg); ± 0.15% of reading or better
11	Sensitivity:	1. less than 2 x 10-8 moles adsorbed/desorbed gas with 01 torr transducer.
		2. Should have technology for high sensitivity
12	Maximum P/Po using nitrogen:	Upto0.999
13	Ultimate vacuum:	$5x10^{-9}$ mbar or better
14	Degassing:	1. The system should have smart degassing to monitor pressure and pause heating and able to automatically terminate heating according toprogrammable test. Should have refillable cold trap.
		2. The system should automatic backfill from dedicated gas input or isolate under vacuumat end of degassing.
15	Pressure	Pressure Measurement Resolution at each micropore analysis port: 0 to 0.1 mmHg Transducer: 0.0000001 mmHg 0 to 10 mmHg Transducer:0.00001 mmHg 0 to 1000 mmHg Transducer: 0.001 mmHg
16	Pressure gauge	A suitable gauge is to be provided to measure the specified range.
17	Heating mantles	Temperature should go upto 350 ^{o} C and suitable thermocouples for over-temperaturesafety.
18	Dewar vessel	The Dewar vessel should have enough capacity to extend uninterrupted analysisperiod over50 hours without refill.
19	Gas cylinder:	N_2, CO_2 and He Cylinder with two-stage regulators for individual gas type should be provided. It should be of 99.999% pure
	Accessories to be quoted and supplied along with machine / equipments:	

20	Reference materials	Certified reference standards (Suitable standards for micropore &mesopore range) to be supplied for while making adsorption studies.
21	Sample cell:	· Standard sample cell: 10 nos. · Small sample cell: 10 nos. · Large sample cell: 10 nos.
22	Other Consumables	Additional Consumables like O-Rings,suitable filler glass rod, etc for 3 years.
23	Transducer	Additional set of all transducers: one each
24	Cryo cooler	Cryocooling accessories may be quoted to generate isotherms attemperature between 20K and 320K
25	Computer system and software	1. High-end with state-of-the-art hardware: Processor 1.8 GHzIntel core i7, 8 GB RAM, 1 tb Hard Drive, CD ROM, network card, USB ports, keyboard, mouse, Microsoft Windows 10 (64 bit), 27 inch Monitor and laser printer
		2. UPS (5 KVA) for 1 hour or higher power backup (3 years warranty on UPS and 3 years warranty on batteries).
		3. Licenses for all the desired software (including NLDFT and QSDFT for accurate micropore size) for both data collection and analysis should be available.
	Non-technicalparameters	
26	Warranty	3 years warranty should be provided with continued software upgradation from the date of installation.
		The duly authorized representative(s)/scientists of the CIPET shall have the right, before payment, to inspect the Goods either at the OEM stores/during manufacture, or at the Place(s) of Delivery. The Supplier shall provide all facilities for such inspection.

		Any inspection carriedout by representative(s) of the CIPET or any waiver thereof shall be without prejudice to otherprovisions of the Contract concerning obligations assumed by the Supplier, including specifications of the Goods.
27	Inspection and acceptance	Upon delivery and inspection of the Goods, the CIPET shall inspect the goods as soon as possible and complete the Goods Receiving Document. Should any Goods fail to conform to the technical specifications, codes and standards under the Contract, the CIPET may reject the Goods. The supplier shall, at no cost to the CIPET, replace the rejected Goods or, alternatively, rectify the non-conformity.
		In the case of Goods ordered on the basis of specifications or samples, the CIPET shall have the right to reject the Goods or any part thereof and terminate the Contract if the Goods do not conform to the specifications and/or samples. Nothing in this clause shall in any way release the Supplier from any warranty or other obligations under the Contract.
28	Training and Installation	1. The equipment should be installed by certified engineer of the firm
		2. Two personnel should be given training at the OEM factory site. Onsite training (03 days) should also be provided to the staff after installation. The Supplier shall provide all facilities for such training programme.
		3.The vendor should have proper application laboratory in India to assist us in methoddevelopment, sample analysis, training and on our applications.
		4. Complete set of manuals for the operation of equipment should be given.

29	Documentation:	CE marking confirmation, Installation documentation, operation and maintenance Manuals on CD, and OEM manuals should be provided with the system

Micro - Raman Spectrometer		
Sl. No.	**Specification**	**Range / Value**
1	**SPECTROMETER**	Full automated Confocal Laser Raman System with the capabilities of recording Raman spectrum (both Stokes and Anti-Stokes). The Spectrometer should be inclusive of research grade confocal microscope with objectives, detector, Lasers, optics along with relevant software computer platform and other necessary accessories for all components of the machine. Allows recording the full Raman range with high resolution
2	Spectrometer range:	200 nm – 2200 nm or wider
3	Spectral Range:	The spectrograph should allow spectral coverage from 80 cm^{-1} to 4000 cm^{-1} in one single continuous acquisition without any step and stitches maintaining 1cm^{-1} spectral resolution.
		Future upgradation at site for lcut-offoff Raman filter ~10 cm^{-1} for 532nm laser
4	Spectral resolution:	0.5 cm^{-1} or better
5	Scan repeatability:	0.05 cm^{-1}or better (at least 20 measurement)
6	Spatial resolution:	0.5 micron or better (lateral) and 0.1 micron or better (axial)
7	Focal length:	250 mm or better
8	Gratings:	Two gratings 1200 gr/mm and 2400 gr/mm, mounted on encoder feedback controlled grating stage and must be controlled by software. The gratings should be quickly and easily interchangeable without realignment.
9	Sensitivity:	S:N for 3rdorder Si better than 20:1 and 4th order better than 4:1

10	**LASER**	All the lasers should be air cooled for maximal confocal performance and should be directly coupled or Fiber coupled and have atleast 3000 hours operational warranty
11	UV:	325 nm suitable laser, 100 mWor better
12	Visible:	Air cooled, Diode Laser 532 nm, 100mW or more with variable intensity
13	NIR:	Air cooled, Diode Laser 785 nm, 300 mW or above with variable intensity
14	Filter:	The filter set for each wavelength including laser line filter, edge filter, and notch filter should be provided.
15	Laser Power Control	Filter wheel 100%, 50%, 25%, 10%, 5%, 3%, 1%, 0.1%, 0.01%
16	**MICROSCOPE**	Microscope should be upright and directly coupled to the spectrometer
17	Sample observation:	High resolution colour digital video camera and White LED Source for illumination.
18	Confocal optics:	True Confocal
19	Objective lens:	10x, 20x, 50x ultra long working distance,100x oil immersion objective lens. Provision to add additional Objectives in the future.
20	Measurement:	Confocal measurements with < 2 µm depth resolution or better
21	Sample scanning stage:	XYZ motorized stage (75 mm x 50 mm x 25 mm or more) with 50 nm (or better) step size in XY & 10 nm (or better) in Z direction with Joystick as well as computer-controlled for 2D/3D Raman imaging measurements
22	**DETECTOR**	A multichannel Charge coupled device (CCD) detector with Peltier cooled to -60°C or better
23	Pixel:	1024 x 250 pixel or better
24	Pixel Size:	26 µm x 26 µm or better
25	Quantum Efficiency:	45% or greater

26	Imaging speed:	1000 spectra /sec or better
27	Upgradation option:	System should be field upgradable with AFM, Profilometry, highly precise time-resolved measurement of fluorescence and luminescence
28	Software and computer system	instrument control and data acquisition software, fully integrated data analysis and presentation software with image capture software for white light image display and capture. Raman and photoluminescence mapping and storage. Standard Library with life time validity for polymer/organic materials. The software should have advanced chemo ‑metric and Macro Programming capabilities and the Software should have Auto validation and auto calibration. Alteast 5 offline software should be provided. i7 processor 10th generation, 16GB RAM, DVD - RW, 500 GB SSD, Windows 11 with lifetime licence, Latest microsoft Office professional, 27” LCD display (2 nos), Wifi enabled or with better specifications along with a suitable color printer for imaging data UPS for 1 hour or higher power backup (Atleast3 years warranty on UPS and 2 years warranty on batteries).
	Non-technical parameters	
29	Warranty	Atleast 3 yearswarrantyshould be providedwithcontinued software upgradation as and whenreleased.
		The duly authorized representative(s)/scientists of the CIPET shall have the right, before payment, to
		inspect the Goods either at the OEM stores/during manufacture, or at the Place(s) of Delivery. The Supplier shall provide all facilities for such inspection. Any inspection carried out by representative(s) of the CIPET or any waiver thereof shall be without prejudice to other provisions of the Contract concerning obligations assumed by the Supplier, including specifications of the Goods.

30	Inspection and acceptance	Upon delivery and inspection of the Goods, the CIPET shall inspect the goods as soon as possible and complete the Goods Receiving Document. Should any Goods fail to conform to the technical specifications, codes and standards under the Contract, the CIPET may reject the Goods. The supplier shall, at no cost to the CIPET, replace the rejected Goods or, alternatively, rectify the non-conformity.
		In the case of Goods ordered on the basis of specifications or samples, the CIPET shall have the right to reject the Goods or any part thereof and terminate the Contract if the Goods do not conform to the specifications and/or samples. Nothing in this clause shall in any way release the Supplier from any warranty or other obligations under the Contract.
31	Training and Installation	Two personnel should be given training at the OEM factory site. Onsite training (03 days) should also be provided to the staff after installation. The Supplier shall provide all facilities for such training programme.
32	Documentation:	ISO9001 quality certification, CE marking confirmation, Installation documentation, operation and maintenance Manuals on CD, and OEM manuals should be provided with the system

Universal Testing Machine (100 KN)		
Sl. No.	**Specification**	**Range / Value**
1	Make & Model	To be specified by the Bidder
2	Purpose	Determination of Tensile, Flexural, Compressive and Shear Properties of Polymeric Materials including Plastics, Elastomers, Fibers / filaments / yarns, FRPs, Films/sheets, woven sacks, geomembranes, etc.
3	Reference Standards	IS / ASTM / ISO Standards relevant to Plastics, Elastomers, Fibers, FRPs, Films / Sheets / Woven sacks / Geomembranes etc.
4	**Capacity**	100 kN
4.1	Control System	Microprocessor controlled

5	**Cross Head Speed / Test Speed**	
5.1	Maximum Test Speed	> 500 mm/min
5.2	Minimum Test Speed	≤ 0.005 mm/min or better
5.3	Accuracy	0.1% of set speed or better
5.4	Return Speed	500 mm/min or better
		speed selection should be possible
5.5	Resolution of crosshead speed	≤0.1 µm/min
5.6	Jog Speed	Provision to specify jog speed to protect samples of light materials while mounting
5.7	Resolution of crosshead displacement	≤0.1 µm
5.8	Maximum force at full speed	100 kN
5.9	Position control resolution	0.0001 mm or better
5.1	Position measurement resolution	0.1 µm or better
5.11	Total crosshead travel	1050 mm or more
5.12	Total Vertical Test Space	1200 mm or more
5.13	Space between columns (horizontal daylight)	550 mm or more
6	**Load/Displacement reading interchangeability**	
6.1	Load	N, kN, g, kg, lb
6.2	Displacement	mm, cm, inch
7	**Load Measurement**	
7.1	Load Cell Capacity	100 kN - 1 no.
		10 kN - 1 no.
		1 kN - 1 no.
		100 N - 1 no.
7.2	Accuracy	± 0.5% of reading or 0.01% of capacity (whichever is less)/as per ASTM and ISO

7.3	Repeatability	± 0.25% of reading or 0.005% of capacity (whichever is less)/as per ASTM and ISO
7.4	Resolution	0.0004% of capacity or less
7.5	Load Cell Calibrator	Calibrator complying for 100 kN, 10 kN, 1 kN and 100 N to be supplied with the system.
8	**Strain Measurement**	
8.1	Extensometer	Laser / Any other non-contact method
		Capable for use under ambient conditions as well as elevated and sub-zero temperature inside environmental chamber
		Vertical travel - 600 mm or better
		Resolution - 0.02 mm or better
		Accuracy - 1% on 25 mm & 50 mm gauge length
		Contact extensometer suitable for measuring elongation, young's modulus and poisson's ratio (provision for keeping the extensometer within the machine when not in use)
8.2	Relative Error (% strain)	±0.5% max
		Grips & Fixtures for 100KN Load Cell
		Manual Wedge grip
		Tensile ASTM D638, ISO 527, ASTM 3039
		- Suitable for Flat Sample thickness 1mm to 20mm and Suitable for Cylindrical Samples up to 12mm dia
		Compression test fixture complying to ASTM D 695
		Flexural - three point bend and four point test fixture complying to ASTM D 790, ISO 178 for adjustable span 10 mm -500 mm or equivalent. Interchangable option for anvils, rollers and supports
		Fixture for shear as per ASTM D 732
		Roller grips for Belt
		Grips & Fixtures for 10KN Load Cell
		Suitable Pneumatic grip for plastics samples

		Tensile ASTM D638, ISO 527- Suitable for Flat Sample thickness 1mm to 20mm
		Manual Wedge grip up to 10KN
		Tensile ASTM D638, ISO 527- Suitable for Flat Sample thickness 1mm to 20mm
		Tensile Grip IS 1969 for woven sacks (50 mm width)
		Compression test fixture complying to ASTM D 695
9	**Grips & Fixtures (for Tensile, Flexural, Compression, Shear as per ASTM / ISO standards for Plastics, Elastomers, Fibers, FRPs, Films) -For all load cells (100 kN, 10 kN , 1KN & 100N) with Suitable extension rod for environmental chamber**	Flexural - three point bend and four point test fixture complying to ASTM D 790, ISO 178 with adjustable span 10 mm -300 mm or equivalent. Interchangable option for anvils, rollers and supports
		Fixtures for 180° peel as per ASTM D 3330 Fixture for shear as per ASTM D 732
		Roller grips for Belt ASTM D 3950
		Grips & Fixtures for 1KN Load Cell
		Pneumatic grip (for Flim,rubber, fibre/filament)
		Tensile ASTM D882- Suitable for Flat Sample thickness 10 micron to 5 mm and Width 25 mm
		Manual Wedge grip
		Tensile testing of Yarns and Threads MPCF type grips
		Tensile ASTM D882- Suitable for Flat Sample thickness 10 micron to 5 mm and Width 25 mm
		Flexural - three point bend fixture complying to ASTM D 790 with adjustable span 10 mm -300 mm or equivalent. Interchangable option for anvils, rollers and supports
		Fixtures for 180° peel as per ASTM D 3330
		Grips & Fixtures for 100N Load Cell
		Pneumatic grip (for Flim,rubber, fibre/filament)
		Tensile ASTM D882- Suitable for Flat Sample thickness 10 micron to 5 mm and Width 25 mm

		All the Fixtures such as Tensile grips, mechanical wedge grips, roller grips, pneumatic vice grips should suitable for low and high temperature testing and can be accommodated into environmental chamber.
10	**Environmental Chamber**	
10.1	Operation Temperature range	-70 to +300°C or better
10.2	Accuracy	0.5°C over the entire range
10.3	Ramp Rate	10°C/min or better
10.4	Chamber Dimension	Suitable for elastomeric samples
10.5	Cooling Medium	Liquid Nitrogen (Dewar Flask of required capacity to be provided) and required accessories
11	Machine Control	An integrated control system and measuring electronics with dedicated Graphical UI application software to performing the tests
12	Cross Head Control	AC Servo Motor driven by digital controller with a minimum cross head movement resolution of 1 µm or better
13	Measuring Electronics	A computerized Data Acquisition Electronics with signal conditioning amplifiers with sufficient bandwidth for measurement of Load and Strain, Cross head position with integrated application software
14	Data Acquisition Sampling Rate	Min 500 Hz or better
15	Analog Output	Shall have analog output to connect to external recorder corresponding to measured Load, Extensometer at ± 10V Full Scale
16	Remote Control	Shall be provided to move the Cross head, Grippers, Emergency Stop etc.
17	Control mode	The test controller should operate in
		a. Load control.
		b. Strain control.
		c. Stress-control.

18	Test Mode	d. Speed control.
		e. Position Control
		Tensile test
		Compression test
		Flexural tests
		Shear tests
19	Methods	Built in Test Methods from ASTM, ISO etc., to meet Polymeric Materials including Plastics, Elastomers, Fibers / filaments / yarns, FRPs, Films/sheets, woven sacks, geomembranes. AND should have capability to create user defined test methods & sequences
20	Graph Display on screen	Must be able to plot/display real time online illustrative graph on display screen for the following:
		a. Load Vs Displacement (i.e. Crosshead)
		b. Load Vs Extension (from extensometer)
		c. Load Vs Time.
		d. Stress Vs Strain.
		e. Displacement Vs Time.
		f. Strain Vs time
21	Data measurement and storage	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 (N / kN / kg)
		Elongation (%)

		Modulus of Elasticity
		After Test, data sheet and graph should automatically stored in defined folder (data sheet in excel and pdf format, Graph in JPEG, bitmap, pdf etc) apart from software
22	Area Calculation	Should readily accept variety of sample geometry like, Rectangular, Cylindrical, Tube, ring etc. with option to enter the cross section area directly for irregular shaped sample. Calculation of area shall be automatic. Also the area calculation can be customized as per customer requirement.
23	Software and its additional Specification	The software must have three level of user access based on login name and password protection.
		Required number of live display window shall be available for display simultaneously.
		The software shall allow the user to define significant digits or decimal places for all live displays.
		Software shall have auto scaling plots.
		The software shall allow for recording of a test with a USB camera device (such as a webcam).
		The software shall allow for result to display in the live display after test.
		The software shall allow for peak, modulus of elasticity and yield calculation to be evaluated real-time during the test and displayed in the live displays.
		Machine - Controller Interface through USB High Speed Data Transfer rate of 1 kHz or better
		Software to be able to perform cyclic tests and Segmented Control profiles under position, load and strain control modes
		Software should have calculation of key test results such as Peak values, Break values, UTL, UTS, Young's Modulus, Yield stress and strain, 0.2% Proof stress and strain, Area under the curve, loads @ specified elongations, elongations @ specified loads etc.

		Software should have automatic printable view of Graph and Report with Statistical Analysis such as Mean, Min, Max, Std Deviation etc. for multi specimen testing.
		Raw test data should be accessible in Microsoft Spread Sheet program ex: MS Excel.
		It should store test data and results to hard disk in ASCII delimited format for easy import into popular Spread-sheet and database programs.
		Software must be perpectual with all latest advance modules.
24	Computer and printer	Standard latest computer system with updated configuration (Windows 10 OS or better) compatible with the current as well as the upgraded software version along with colour printer and all other requisite accessories
25	Mandatory Standard Accessories to be provic	All necessary grips and fixtures for all load cells for all tests - Tensile, Compression, 3 & 4-Point Bend, Peel, Tear, Friction, Shear, Tests
		All grips shall comply to IS / ASTM / ISO standards for Plastics, Elastomers, FRPs and filaments / Yarns.
		Bidder should specify and quote for any other acessories required / availble for better usage of machine.
26	Other Conditions	Equipment to be calibrated for force and extensometer as per ASTM / ISO standards for Plastics, Elastomers and FRPs
		Calibration certificate - NIST Traceable or from an NABL Accredited Laboratory should be provided
27	Spares	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 on continuous two-shift per day basis. The supplier shall submit the quotation with all the requisite technical literature, substantially describing the features of the system.

28	Power Backup	Instrument should have power backup of min 45mins. UPS with suitable capacity to be provided along with the equipment.
29	Acceptance Criteria	The Supplier should be original equipment manufacturer (OEM) or Authorized Representative. In case of authorized representative letter of authorizartion from OEM shall be submitted.
		Minimum 5 nos of similar equipment should be supplied in India to Govt. Institutes or R&D Organizations or reputed Industries. Performance certificate from the institution / organization on present date to be provided.
		Factory Trained Personnel should be available in India for post sales services.
		Pre-dispatch inspection of the system shall be carried out at the time of final assembly and testing in the presence of purchaser ' s representatives, at supplier's place
		The supplier shall agree to carry out any modifications in the system, free of cost, as suggested by Purchaser's Inspector during Inspection/Training at Supplier ' s works, for meeting the overall scope of requirement and performance of the system.
30	Scope of Supply / Bill of Material	Bidder should submit Scope of Supply / Bill of Material with make model of each items.

Colour Spectrophotometer		
Sl. No.	**Specification**	**Range / Value**
Make / Model		**Bidder to specify**
1	Purposes	To measure Colour, Grey Scale rating and Yellowness Index as per various Indian and International standards.
2	Applicable standard	ASTM D2244, ASTM D1925, ASTM E313, ASTM E308, ASTM E1164, CIE 15: 2004
3	Measurement principle & Mode	Dual beam spectrophotometer
4	Light Source	Pulsed Xenon lamp filtered to approximate D65 daylight

5	Detector	Silicon Photodiode array
6	Viewing Aperture	Large area view : 25.4mm or equivalent. Illuminated.
		Small area view : 12 mm or equivalent. Illuminated
7	Lens switching for LAV/SAV	Automatic
8	Spectral Range	360 - 700 nm or better
9	Resolution	< 3nm or better
10	Effective Band width	10 nm equivalent triangular
11	Photometric range	0 - 150%
12	Photometric Resolution	0.01% or better
13	Lamp life	More than 3 million measurements
14	Automatic UV Control	420nm cut off filter for UV Control &UV Exclusion
15	Measurement Time	< 5 seconds or better; (except 3mm area<10sec.)
16	Calorimetric repeatability	For white tile: ΔE* < 0.09 or better for 1.75 inch
		For Blue denim tile: ΔE* < 0.07 or better for 1.75 inch
17	Inter instrument agreement	ΔE*< 0.15 (Avg.) for 1.75 in.
		ΔE*< 0.36(Max.) for 1.75 in. CIE Lab (max.)
18	Equipment to be supplied with all essential Accessories such as:	Calibrated white UV Fluorescent Standard with NIST Traceable certificate of calibration - 01no
		Sample Cup Opaque Cover - 01 no
		Glass Sample Cup (2.5in) - 04 nos.
		Port insert, 2.5in Glass sample cup holder-01no
		Sample Clamp Assembly - 01 no
		Other parts like cable, adopter, power cord, UPS etc.
		Black Calibration light Trap
		Green Check Tile
		Operation manual
19	Color matching software to measure: L, a, b, Δxyz	Suitable advanced software inbuilt with instrument to analyse L, a, b, ΔE, yellowness index, grey scale rating, etc. Software must be perpetual with all latest advance modules.

21	Other Mandatory Accessories to be quoted and supplied along with machine / equipment	While supplying the Machine, the supplier should also provide the following items apart from above:
		Branded PC of best configuration with necessary software including software for colour matching & suitable for the instrument operation, Colour printer
		Basic tool Kit - 01 set
		Hard copies of Operational & Service Manual - 01 set and certified reference material
		Machine should come with all other essential accessories & spares (as per IS, ASTM & ISO standards) required for installation, commissioning & operation. Bidder should specify and quote for any other accessories required / available for better usage of machine.
		Onsite free operational Training
		Calibration certificate traceable to NIST should be provided
22	Scope of Supply / Bill of Material	Bidder should submit Scope of Supply / Bill of Material with make model of each items.
	Technical Support and Service	The Supplier Shall be responsible for carrying out the installation and Commissioning at customer site.
		Machine Should come with all other essential accessories & spares required for installation, commissioning & operation.
23	Scope of Supply / Bill of Material	Bidder should submit Scope of Supply / Bill of Material with make model of each items.

Oxygen Induction Time		
Sl. No.	**Specification**	**Range / Value**
1	Make / Model	Bidder to specify
2	Purpose	To study the degradation characteristics under oxidative conditions
3	Standards	IS 4984 and ASTM D 3895
4	Temperature Range	Ambient to 300°C or better
5	Resolution	0.1°C or better

6	Accuracy	0.001°C or better
7	Ramp rate	20°C/min. for test & 2°C/min for calibration
8	Controller	Microprocessor based L.C.D. display for process temperature, PID Controller with temperature range up to 300°C or better
9	Maximum Test time (minutes)	0 to 250 or better
10	Gas flow control	Through gas regulator on the cylinder and rotameters on the machine
11	Accessories to be quoted and supplied along with machine / equipments:	200 or more Aluminium Pans, Copper pan 100 nos or more, Indium and/or Tin for calibration, Gas regulators, Specimen holder
12	Cooling System	To be specified
13	System requirmeents	The windows based software to interface the computer, Data entry through software, PC connectivity to be specified Graphical data reports tp be printed through software
14	Scope of Supply / Bill of Material	Bidder should submit Scope of Supply / Bill of Material with make model of each items.

Digital Hydrostatic Pressure Tester		
Sl. No.	**Specification**	**Range / Value**
1	Make / Model	Bidder to specify
2	Purpose	For pipe testing
3	Applicable standard	IS: 4985, IS:12235(Part 8), IS 4985, IS 4984, IS 12786, IS 14333, IS 14151, IS 15328, IS 15801, EN 921:1994, ASTM D 1785
4	Pressure range	0 - 99.99 kg/cm^2
5	Time totalizer	Pressure controller with inbuilt digital programmable time totalizer in all station with range and resolution of 0 – 999.9 / 0 -9999 hours.
6	Number of stations	6 (Six) and 18 Outlets
7	Pressure input	Dry and Moisture free compressed air (up to 7 kg/cm^2)
8	Pressure output	Through electro-hydro pneumatic pump
9	Pressure Control	Six nos. of Digital Pressure controllers

10	Microcontroller	Indicating and controlling pressure
		Range: 99.99 Kg/cm2 with resolution of 0.01 kg/cm^2
		Hour Meter with range of 9999 hrs with indication of hr:min:sec
		Smart control with Digital calibration for pressure to microcontroller
		Lower and Upper band to control pressure within 0.01 kg/cm, burst point to stop the pressure on test failed
11	Setting Parameter	Set pressure, set time, set band, set burst.
12	Failure detection & Burst Indication	Failure detection & Burst Indication through Digital Controller.
13	Piping	With heavy duty copper piping suitable for hi pressure test application.
14	Fitting component	Made of SS and Brass material
15	Test	All station are suitable for long term and short term test.
16	Pipe Testing	Six stations with eighteen outlets each to test 3 different size of samples at a time.
17	Water Input	Overhead tap water with 80 micron filter or better
18	Four sets of End caps / End fittings including spares	a) 16 mm, 32 mm, 40 mm, 50 mm, 63 mm, 75 mm, 90 mm, 110 mm (Aluminium with sliver paint clamps M.S hard chrome plated locking plugs).
		b) 125 mm, 140 mm, 160 mm, 200 mm (Material-M.S hard chrome plated clamps and locking plugs).
19	Type	Floor type
20	Paints	Powder Coating
21	Any other accessories	Bidder to specify and supply
22	Scope of Supply / Bill of Material	Bidder should submit Scope of Supply / Bill of Material with make model of each items.
Water bath for Hydrostatic Pressure Tester (Room Temperature to 100°C)		
Sl. No	**PARAMERTERS**	**SPECIFICATION**
1	Make / Model	Bidder to specify
2	Purpose	For pipe testing

3	Applicable standard	IS Standards for pipe testing
4	Size of inner S.S Chamber	2 m (L) X 1.5m (W) X 0.8 m (H)
5	Working Temperature Range	Ambient to 100 °C
6	Temp. controller	Digital PID controller with range ambient to 100°C with L.C. of ±0.1°C for Hot water bath application
7	Accuracy	± 1°C or better
8	Circulation	Inbuilt Water circulation pump
9	Compressor	Bidder to supply suitable compressor
10	Load	As Per the Requirement of Bath
11	Paint	Powder coating
12	Power	440 V AC, 3 Phase
13	Other	Puff Insulation
14	Type	Floor type
15	Any other accessories	Bidder to specify and supply
16	Scope of Supply / Bill of Material	Bidder should submit Scope of Supply / Bill of Material with make model of each items.
Water bath for Hydrostatic Pressure Tester (10 – 30°C)		
Sl. No	**PARAMERTERS**	**SPECIFICATION**
1	Make / Model	Bidder to specify
2	Purpose	For pipe testing
3	Applicable standard	IS Standards for pipe testing
4	Size of inner S.S Chamber	2 m (L) X 1.5m (W) X 0.8 m (H)
5	Working Temperature Range	10 – 30°C
6	Temp. controller	Digital PID controller with range 10 – 30°C with L.C. of ±0.1°C for Cold water bath application
7	Accuracy	± 1°C or better
8	Circulation	Inbuilt Water circulation pump
9	Compressor	Bidder to supply suitable compressor

10	Load	As Per the Requirement of Bath
11	Paint	Powder coating
12	Power	440 V AC, 3 Phase
13	Other	Puff Insulation
14	Type	Floor type
15	Any other accessories	Bidder to specify and supply
16	Scope of Supply / Bill of Material	Bidder should submit Scope of Supply / Bill of Material with make model of each items.

Toxixity Chamber		
Sl. No.	**Specification**	**Range / Value**
1	Standard	Equipment should complies to NCD 1409
2	Purpose	To study the combustible characteristics of the materials determine the toxicity
3	Chamber	All items inside the test chamber should be coated with inert / non metallic materials.
		Chamber to be fitted with forced air extraction system which can be closed at exit.
		Chamber should contain a mixing fan - Switch ON & OFF externally. The fan should be six bladed - minimum diameter of 200 mm. The fan should be placed horizontally and centrally inside the chamber at roof level.
4	Burner	Capable of achieving flame with temperature of 1150°C±50°C at the hottest point
		Burner should operate with methane gas having gross calorific value of approx. 40MJ/m3.
		Bunsen Burner: Overall height - 125 mm, 11 mm bore burner tube and 5 mm bore gas and air inlet tubes.
		Flow rate: 10 to 15 Litres per minute
		Provision for Igniting & extinguishing the burner from outside the chamber to be provided.

5	Specimen support	Suitable support to be provided to mount the specimen above the burner without masking to the flame. Support Material: Non-combustible material such as sheet steel, thickness: 2-4 mm, Annulus cut - 100 overall diameter with 75 mm diameter hole carrying temperature resistant wires approximately 100 mm apart to form a lattice (Like a tennis racket apperance).
6	Timing device	Capable of measuring time upto 5 minutes with accuracy of ± 5 seconds
7	Gas detection system	Colorimetric gas reaction tube for analysis of gases. Required accessories such as pump, display, etc to be provided for rapid detection and estimation of gases released during comusion of materials.
8	Volume of the chamber	1 m3 as per NCD 1409
9	Flow meter	15 LPM for natural gas and 20 LPM for air
10	Temperature Indicator	Digital type with K-Type thermocouple
11	Timer	Digital timer with accuracy of ± 1 second and capable of counting not less than 10 minutes
12	Blower	Electric operated
13	Others	Bidder should specify and quote all the mandatory requirements / Any other accessories for smooth operation of the equipment
14	Scope of Supply / Bill of Material	Bidder should submit Scope of Supply / Bill of Material with make model of each items.