

**Technical Specification of Processing, Tooling, Testing and R&D Equipments /  
Machinery, Hardware & Software**

**1                      MICROPROCESSOR CONTROLLED PET PREFORM STRETCH BLOW MOULDING  
MACHINE - 1 LITRE CAPACITY**

S. NO.	ITEMS	SPECIFICATION
1	Container volume - ml	50-1000
2	Output (bottle per hour) (Min.-Max.) - Nos.	700-2000
3	No. of cavities - Nos.	2
4	Max. Bottle Height -mm	350
5	Moulds: Suitable for 500 ml & 1000ml product size	Please Quote
6	Preform neck diameter - mm	25-46
7	Microprocessor Control System	Please specify and quote
8	<b>OTHER FEATURES</b>	
	i) Preform preheating system	Please specify
	ii) Preform feeding	Please specify and quote
9	Safety	Appropriate safety features to be provided
10	Total connected load	Please Specify & Quote
11	Max. Power Consumption @full machine capacity	Specify (Lower power consumption machine will be preferred)
12	M/c dimensions	Please specify
13	Essential Spares	Please Specify & Quote
14	<b>Air Compressor</b>	<b>Please Specify &amp; Quote for suitable Air compressor</b>
	i) Working Pressure - bar	10 to 12
	ii) Blowing pressure - bar	30-40
	iii) Air consumption for Machine - m <sup>3</sup> /min.	1.5-2
15	<b>Chiller</b>	<b>Please Specify &amp; Quote for suitable Air compressor</b>
	i) Operating pressure - bar	5 to 8
	ii) Temperature range - °C	5 to 10
	iii) Water Consumption - L/min.	30-40

**2                      PIPE EXTRUSION UNIT WITH JOCKEY EXTRUDER FOR LINE MARKING**

1	Polymer to be processed	HDPE
2	<b>Screw Diameter - mm</b>	30 – 45mm
3	L/D Ratio	30 to 35: 1
4	Output - <b>Kg / hr.</b>	90-120
5	Pipe / Tube Outside Dimensions - mm	20-110 mm dia Pipe
6	Calibration / Sizing/Cooling tank Vacuum Operated with Suitable Stainless Steel Cooling Tank with arrangement of Re-circulating Water for cooling.	Please specify

7	Haul off unit (Suitable Haul off Unit with PLC control)	Please specify
8	Cutter - Synchronized cutter to be incorporated for both flexible and rigid pipe/tube.	Please specify
9	Coiler for pipe	Please specify and Quote
10	Die Size - 40 mm & 90 mm - mm	Please Quote for two set of die
11	Total Connected Load - Kw	Please Specify
12	Control System	Microprocessor/ PLC Controls/ Computer Integrated Control with full machine Synchronization with single point of control to be provided
13	Safety	Appropriate safety features to be provided
14	Standard spares	Please specify and quote
15	Max. Power Consumption @full machine capacity	Specify (Lower power consumption machine will be preferred)
16	Machine dimensions (LxWxH) - M	Please Specify

3

### Processing Simulation Software

1	eLearning Modules and eLearning Videos	The content should be user-friendly, computer-based interactive training lessons on computer. Module should include Safety &PPE, Plastics Material, Plastic processing methods, Trouble shooting, Moulds and Mould maintenance, Mould design, DOE, Statistical Process control, Auxillary equipment training etc
2	Operating system	Windows Should run on Windows 10, 8, 7, Server 2016, 2012, 2008
3	Hardware	Should be compatible with Intel® Core i5 processor, 4 GB RAM, and 20 GB free space
		Online support for minimum 3 years with updates and perpetual licence to be provided for all modules
4	kindly specify and quote for module and Content wise	Injection Moulding, Blow Moulding Extrusion Moulding

4

### Hydrostatic pressure testing machine for pipes with 6 long term stations

1	Test Standard	HDPE, PVC, PPR, Lateral pipes as per IS 4985, IS 4984, IS 12786, IS 14333, IS 14151, IS 15328, IS 15801, EN 921:1994, ASTM D 1785 & other relevant standards
2	No. of Stations	06 (Min)

3	Unit of pressure	kg/cm <sup>2</sup> , MPa, BAR
4	Pressure Range	0.00 to 99.99 kg/cm <sup>2</sup>
5	Pressure Resolution	0.01 kg/cm <sup>2</sup>
6	Resolution of Timer	999.9 hrs.
7	Time Range	0.1 hour/6 minute
8	Hydraulic Circuit	Made from corrosion-less S.S. 304 tubing and fittings
9	Compressed air requirement	Min. 3.0 kg/cm <sup>2</sup> form compressor unit
10	Pressure Developing System	Through hydro-pneumatic type reciprocating pump
11	No. of Pumps	02 pumps
12	Pressure control system	Hydro-pneumatic pressure regulating device with individual control of station.
13	Power Supply	230V AC, Single phase, 50Hz
Display Regulating accuracy		0.5 % of full scale
<b>Equipment should fulfil the following features</b>		
	The instrument must be suitable to carryout Hydro static Pressure Test as per ASTM D 1785	
	Fine Filter has to be provided for water inlet	
	01. Provision to record the starting time, Time of failure, over pressure time, pressure compensating time etc. Digital Hydro-static pressure (3Station) 250 Bars FOR Burst Test.	
Other Specifications :01. Microprocessor based pressure controller to maintain the pressure within 0.5% accuracy of full scale.		
02. Fully hydraulic Pneumatic system with central pressurized water supply. Reliable high-pressure pneumatic pumps with operating pressure up to 260 bars.		
03. With help of the digital controller machine can work as a burst tester or single station hydro-static pressure		
04. User friendly microprocessor based digital pressure controller .		
05. LCD based microprocessor with buzzer output.		
06. Maximum pressure range 0-250 bars.		
07. Air less motorized pumping stations is provided to build the pressure very fast.		
08. All stations are provided with the QRC coupling to save preparation time.		
09. Auto protection of pressure transducers is also in built feature and a part of machine. Power supply: 3phase+Neutral+Earth with 15Amps power supply are required at customer end.		

**UV weathero meter**

	Applications	To simulate, accelerate and correlate the artificial sunlight / weathering atmosphere for polymers, coatings, etc.
	Effective radiation area	4000 cm <sup>2</sup>
	Components surface temperature	45°C to 80°C for UV Cycle
		45°C -60°C for Condensation
	Temperature accuracy	± 0.1°C or better
	Temperature resolution	1°C or better
	Temperature controller	Black Panel Temperature

	Centre distance of lamp	5 cm
	Humidity	100%
	Light source	UV-B Fluorescent Lamp
	Wavelength	UVB (313 nm)
	Minimum sample holder plates	Aluminum Plates 24 sample holders
	Conditioning cycle	Light cycle and Condensation cycle
	Irradiance Calibration	Irradiance calibration (calibration radiometers for periodical calibration) with NIST traceability ( UVA & UVB)
	Irradiation Control	Irradiation control (solar eye automatically maintain light intensity through feedback loop this controller monitor UV intensity and compensate lamp aging or any other variability by adjusting power to the lamp) with NIST traceability
	Conforms to standards	ASTM G151, ASTM G 154, ISO 4892 (1 – 3), SAE J2020
	Warranty	Minimum 3 years of warranty to be provided
	Scope of supply	Complete list of items quoted are to be provided
	Installation requirements	Bidder to specify the preinstallation requirements
	Training	Onsite training for system operation and maintenance as well as application support should be provided by the vendor at its own cost.
	Service	Appropriate tool box/kit for routine maintenance should be provided with the equipment
		All documents (i.e. operating & service manuals, drawings etc.) and original softwares relevant to the instrument and its accessories must be supplied.
		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.
		Power and receptacle/socket as per Indian Standards should be provided.
		The vendor shall have local service and application office and infrastructure to attend by visit within 48 hours of need.
		The vendor should have technical support in the area of application and service available within the country

**Pipe-end fittings for conducting pressure test**

1	material.	
2	Adequate no. of accessories, bolt , nuts Allen key screw ,connection nipple must be stainless steel ,copper/ brass ,	
3	Complying standard – IS: 4984-2016 (Cone type)	Size of pipe Dia (mm): 16,20,25,32,40,50,63,75,90,110,125,140,160, 180,200,225,250,
4	IS: 4985-2000 (Type –A)	Size of pipe Dia (mm): 16,20,25,32,40,50,63,75,90,110,125,140,160, 180,200,225,250,
5	IS: 15778-2007	Size of pipe Dia : (15- 150)

**DYNAMIC MECHANICAL ANALYZER (DMA)**

1	Temperature Range	from -150°C to 500 °C or better on both side
2	Temperature Resolution	0.1 °C
3	Heating Rate	0.1 to 20 °C/min or higher
4	Cooling Rate	0.1 to 20 °C/min or higher
5	Cooling system	Automated cooling system should be provided to achieve the specified low temperature
6	Force Range	18 N (Max) and 0.001N (Min)
7	Force Resolution	0.0005N or better
8	Tan δ Range	0.0001 to 10
9	Resolution	$1.0 \times 10^{-4}$
10	Sensitivity	$1.0 \times 10^{-3}$
11	Sample Deformation modes	Single and dual cantilevers bending modes: 3-point bending mode Tension and compression modes Shear Mode (Film sample also) (Fixtures should be provided to all modes)
12	Sample Deformation Range	1 mm to 1 cm or better
13	Amplitude resolution	10 μ or better
14	Modulus Range	$10^3$ to $10^{13}$ Pa
15	Modulus Resolution	0.01 Pa
16	Frequency Range	0.001 to 300 Hz with minimum of 0.01 Hz increment or better
17	Liquid Nitrogen Dewar	Dewar of capacity of 50 ltr or better should be provided in the system
18	Output Values	
	Storage modulus, loss modulus, tan delta, complex Modulus, complex / dynamic viscosity, creep compliance, static / dynamic force, temprature, stress/strain, frequency, sample stiffness, displacement.	

19	Other	• Humidity Controller in the chamber
		• Provision for control flow of N <sub>2</sub> or Air
		• Calibration Standard Kits should be provided
20	Software	compatible to Windows 10 OS and should have the capabilities to programme stress, strain, amplitude etc.
		capable of collecting data on storage, modulus, loss modulus, tan delta, complex modulus, complex / dynamic viscosity, creep compliance, etc.
21	Workstation	Branded Desktop PC ( i7, 8 Gb RAM, 1Tb HDD 21 " LCD display,) Inkject colour Printer & Branded UPS
22	Accessories	Bidder to specify and quote any ther accessories rquired for the better utilisation of the equipment
23	Scope of supply	Bidder should submit complete scope of supply (Machine, standard acessories, Optional Acessories etc with make model) in the technical bid without price.Bidder should supply complete start up package including material necessary to prove the machine and provide training.
24	Installation and 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
25	Technical support and service	Manufacturer should have established after sales & service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 48 hours of need. 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.
26	Annual Comprehensive Maintenance Contract (ACMC) as optional	Vendor should quote for Annual Comprehensive Maintenance Contract for the whole system and accessories supplied after the completion of performance warranty period. Supplier has to provide service support within 48 hours. Calibration of the machine shall be a part of warranty and ACMC. It shall also be mandatory to perform calibration after every major repair or breakdown.

### CNC EDM Die Sinking Machine

The CNC EDM with C-Axis should be capable of wear free ED machining with graphite electrode and copper electrode as per the following detailed specification.

1	Machine Dimensions	
1.1	Work Tank Size - mm	(1100-1300) x (750-900)x (450 -550)
1.2	Work Table Size - mm	(750-850) x (500-700)
1.3	Maximum workpiece size - mm	(1000-1200) x (650-800) x (350 -450)
2	Axis Travel	
2.1	X-Axis - mm	550-650
2.2	Y-Axis - mm	350-450
2.3	Z-Axis - mm	350-450
2.4	High speed X,Y,Z axis - m/min	5 or better
2.5	C Axis Rotation Speed Range - rpm	1 - 20 or better
2.6	Min./Max. distance between table and chuck - mm	250 or better
3	Measurement resolution - $\mu\text{m}$	0.5 or better
4	Axis Positioning Movement	Up to 4 Simultaneous
5	Axis Linear Interpolation Movement	Up to 4 Simultaneous
6	Axis Circular Interpolation Movement	Up to 3 Simultaneous
7	Maximum Job weight - kg	>1000
8	Max. electrode weight on automatic chuck - kg	>100
9	Dielectric Unit	
9.1	Dielectric capacity Liters	Specify
9.2	Filtration system - $\mu$	10 or better
9.3	Flushing Injections	Specify
10	Generator	
10.1	Generator type	ISPG Integrated or better
10.2	Machining current - A	80 or more
11	Performance	
11.1	Minimum surface roughness (Ra) - $\mu\text{m}$	0.1 or better
12	Standard Accessories	
12.1	Automatic Tool Changer Linear or Rotary	
12.2	Ethernet, USB ports, RS-232C Communication Ports	
12.3	Rigid Linear Motor (X, Y, Z)	
12.4	Linear Glass Scale Feedback (X, Y, Z)	
12.5	Fire Extinguisher	
12.6	C Axis	
12.7	Super finish Module	
12.8	Zero Wear Module	
12.9	Clamping kit	

12.10	Machine lamp	Set of Standard Accessories suitable to the machine
12.11	Filter set	
12.12	Precision machine vice 4"	
12.13	Flushing system	
12.14	Servo voltage stabilizer	
12.15	Ultra Isolation transformer	
12.16	Chiller Unit	
12.17	Collet holder with collet set	
12.18	Dielectric fluid (Full tank capacity)	
12.19	Technology files in CD form apart from loaded in the pc control	
12.20	Air drier	
12.21	Air gun with pipe	
12.22	3D probe measuring system for Erowa or System 3R	
12.23	Erowa or System 3R electrode holding system kit	
13	Others	Need to specify and quote if any other accessories available /required for smooth
14	Others	Need to specify and quote if any other accessories available /required for smooth running of the machine

9

### CNC Machining Centre / CNC Milling Machine (5 axis)

1	<b>Make</b>	Bidder to specify
2	<b>Model</b>	Bidder to specify
3	<b>Table Dia (Minimum in mm)</b>	Ø630
4	<b>Axis Travel</b>	
4.1	X-Axis (mm)	900 - 1200
4.2	Y-Axis (mm)	600-800
4.3	Z-Axis (mm)	500-700
4.4	A (Degree)	+30° to 120°
4.5	C (Degree)	360° (contionous)
5	<b>Feed</b>	
5.1	Rapid Feed (X, Y,Z Axes) (m/min)	20 or better
6	<b>Spindle</b>	
6.1	Rating (KW)	Bidder to specify
6.2	Max. Speed (rpm)	10000 or better
6.3	Taper	BT40
7	Table surface to spindle nose (mm)	Bidder to specify
8	Table load capacity	800
9	<b>Accuracy</b>	
9.1	Positioning (μ)	10 or better
9.2	Repeatability (μ)	5 or better
10	<b>Automatic Tool Changer (Optional)</b>	
10.1	Magazine capacity (Nos)	20 or better

10.2	Tool select by shortest & Random select	Bi-Directional
10.3	Max. tool diameter (mm)	80 or better
11	<b>Control System</b>	
11.1	Controller	Fanuc / Siemens /or equivalent (Latest with complete module) with the screen size of 19" or more with touch screen technology, app based which leads to a smart paperless shop floor management and monitoring.
11.2	Part Program Storage (GB)	Capable to store large CAM programs for continuous running (Minimum 4 GB)
11.3	Programming Functions with editor	Complete Module with technical calculator for power and torque requirements , with dxf file import facility, 3D simulation
12	<b>Essential Accessories</b>	
12.1	Servo stabilizer	Bidder to specify and quote suitable for the machine
12.2	Ultra Isolation transformer	Bidder to specify and quote suitable for the machine
12.3	Air Compressor with drier and multi dry filter	Bidder to specify and quote suitable for the machine
12.4	Automatic centralized lubrication system	Bidder to specify and quote suitable for the machine
12.5	Touch Probe	Bidder to specify and quote Branded quality(Renishaw / Blum) Touch Probe
12.6	Machine protection	Monitoring vibration during machining to protect machine and spindle failure. User autorisation to the control system and the machine. Safety during power failure and Panel cooler for electrical cabinet. Door interlock for safety
12.7	Industry 4.0 features leads to smart machine	Live status of important component of the machine in operation, internet based remote diagnosis of the machine like fault on the machine
12.8	Operation hardware	Electronic handwheel, Flushing gun for internal cleaning, Coolant tank with chip conveyor

12.9	Tool holding devices (Optional)	<p>Bidder to specify and quote Set of suitable Cutting Tool holders</p> <p>ER 25 collet chuck -1 No.</p> <p>ER 25 collets Dia 3 to Dia 14 in steps of 1mm - 1 each</p> <p>ER 32 collet chuck - 1 No.</p> <p>ER 32 collets Dia 10 to Dia 20 in steps of 1mm - 1 each</p> <p>ER 40 collet chuck -1 No.</p> <p>ER 40 collets Dia 20 to Dia 25 in steps of 1mm - 1 each</p> <p>ER 25 Tap collets with square drive for M8 and M10 taps- 1 each</p> <p>ER 32 Tap collet with square drive for M12 tap-1 each</p> <p>Side lock adaptors Dia 16, 20, 25 &amp; 32 -1 each</p> <p>Keyless drill chuck 0-13mm</p> <p>Holder (adapter) for 40 mm Face mill - 1 No</p> <p>Holder (adapter) for 80 mm Face mill - 1 No</p> <p>Holder (adapter) for 125 mm Face mill - 1 No</p> <p>Holder (adapter) for 50 mm Bull - 1 No</p> <p>Tool locking device-1 No.</p> <p>Pull stud- 30 no's</p>
12.10	Cutting Tools (Optional)	<p>Bidder to specify and quote Set of Cutting</p> <p>Face mill cutter (with replaceable inserts 20 nos.) - Dia 80 mm</p> <p>Bull nose cutter (with replaceable inserts 20 nos)- Dia 50 mm</p> <p>End Mill cutter (with replaceable inserts 20 nos)- Dia 32 mm</p> <p>Bull nose cutter (with replaceable inserts 20 nos)- Dia 25 mm</p> <p>Endmill cutter (with replaceable inserts 20 nos)- Dia 20 mm</p> <p>Endmill cutter (with replaceable inserts 20 nos)- Dia 16 mm</p> <p>carbide End Mill cutter (each two)- Dia. 3, 4, 5, 6, 8, 10, 12, 16 mm</p> <p>carbide Ball End Mill cutter (each two)- Dia. 3, 4, 5, 6, 8, 10, 12, 16 mm</p> <p>M8, M10, M12 HSS Tap with suitable Carbide Drills - 2 Sets</p> <p>HSS Drills ( one set) - Dia. 1 to 20 mm</p> <p>Centre Drill (Carbide &amp; HSS) - each 3 Diff. Sizes</p> <p>Finish boring kit dia 10 to 40- 1 set</p>
12.1	Clamping Kit	Clamp set

12.12	Others	Ethernet, USB ports
12.13	Software	CAM software with post processor suitable for the machine to be quoted separately
13	<b>Any other accessories if available for better utilization</b>	Bidder to specify and quote if any other accessories available /required for smooth running and better utilization of the machine.
14	<b>Terms &amp; Conditions</b>	Manufacture/Supplier should have sizable installations of same or better model worldwide and at least Five in India which is education institutions centrally funded institution. A Satisfactory Performance certificate from two institutions to be provided for eligibility. Bidder should submit complete contact details
		Equipment should be CE certified
		Authorization Letter from OEM
		List of clients in last five years to be provided.
15	<b>Scope of supply</b>	Bidder should submit complete scope of supply (Machine, standard accessories, Optional Accessories etc with make model) in the technical bid without price. Bidder should supply complete start up package necessary to prove the machine and provide training.
16	<b>INSTALLATION, COMMISSIONING AND TRAINING</b>	
16.1	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.
16.2	Training and documentation	Minimum of 5 days training for five persons which includes basic & advanced level training. Training content and plan to be submitted. Training faculty must have adequate experience in this field.
		The vendor should supply the necessary manuals such as
		• Software instruction
		• Maintenance and trouble manual
		• Training
		• Installation and Commissioning
		• Handling of accessories
		• Software key (if any)
		• Software CDs

16.3	Warranty	The whole system and its accessories should be given two years warranty for the machine and three years for the spindle replacement and service against any design, manufacturing and workmanship defects from the date of installation and commissioning.
16.4	Technical support and service	Manufacturer should have established after sales & service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 48 hours of need. Technical support personnel must have adequate experience in this field. Technical support personnel details should be submitted. Name and address of the authorized service centre/ partner in India along with the certificate of authorization should be attached.
16.5	Annual Comprehensive Maintenance Contract (ACMC) as optional	Vendor should quote for Annual Comprehensive Maintenance Contract for the whole system and accessories supplied after the completion of performance warranty period. Supplier has to provide service support within 48 hours. Calibration of the machine shall be a part of warranty and ACMC. It shall also be mandatory to perform calibration after every major repair or breakdown

10

#### Biodegradation set up - incubator type

S.No.	Description	
	Make	Bidder to specify
	Model	Bidder to specify
<b>I. BIODEGRADATION SET UP</b>		
1	Type	Rectangular Incubator type
2	Tempertaure Range	Ambient to 80 C
3	Tempearture Accuracy	± 1 C
4	Control panel	Accomodating digital PID temperature controller, safety thermostat, indicating lamps, temperature display and switches
5	Incubator	Double walled, Stainless steel, Powder coated
		Provision for holding 24 nos of glass dessicator
		Capable to maintain the uniform temperature throughout the chamber
6	Composting Glass Vessel	Capacity: 3000 ml - 12 Nos.
		Capacity: 5000 ml - 12 Nos.
7	Mesh Filter	Filters -24 Nos.

8	Glass Bottles	36 Nos. of glass bottles with 5000 ml capacity with air tight cork fitting
9	Multi Storage Rack	Rack with wheel for accomodating 36 Nos. of 5000 ml capacity glass jars and flow meter attachment
10	FLOW Meters for Incubator	Min 24 Nos. with spare of 24Nos
11	Silicone Hose	300 meters
12	Air compressor	2 HP, Oil free, Robust and Light duty:
13	Set up should be in compliance with standards	ASTM D 5338, IS/ISO 14855 (Part 1), and ASTM D 5988
<b>II. AUTO TITRATOR</b> <b>(Determination of Carbon Dioxide by titration method)</b>		
1	Auto titrator	Microprocessor controlled titration unit capable to carryout potentiometric titration Measuring parameters: pH (0 - 14), Potential (0 - 2 mV), Temperature (0 - 100 C), Electrical Conductivity (0 - 20 S/m)
		Titration measuring method: Automatic end point detection, pH adjustment and measurement.
		Interfaces: Dual RS-232 / USB port for attachmentents to PC, Printer, autosampler, balance.
		Minimum 4 burretes to be connected for measurements simultaneously
		Appropriate dosing units to be provided for automatic sampling for titration
2	Automatic Burette	Volume: 1, 5, 10, 20 and 50 ml
		Resolution: 1/1000 of burette volume or better
		Dropping volume: 50 ml - 0.0025 ml 20 ml: 0.001 ml 10 ml: 0.0005 ml 5 ml: 0.00025 ml 1 ml: 0.00001 ml
3	Data Acquisition	Data should be continuously recorded and export and import in CSV / Excel formats
4	Accessories	All other accessories required for automatic titration starting from autosampling till end point determination has to be provided as standard items.
		Any other accessories for better performance of the titrator can be quoted as optional accessories

<b>III. KJELDHAL APPARATUS</b> <b>(Determination of Organic Nitrogen Content)</b>		
1	Construction	The outer body should be made of Stainless Steel 304 and powder coated
2	Flasks	25 mL, 50 mL, 100 mL
3	Tempertaure controller	Capable of heating upto 500 C
4	No. of recess	06 Nos.
5	Accessories	Any other accessories required for determining the organic nitrogen content
5	Installation and 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	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.
7	Annual Comprehensive Maintenance Contract (ACMC) as optional	Vendor should quote for Annual Comprehensive Maintenance Contract for the whole system and accessories supplied after the completion of performance warranty period. Supplier has to provide service support within 48 hours. Calibration of the machine shall be a part of warranty and ACMC. It shall also be mandatory to perform calibration after every major repair or breakdown.

11

#### High Pressure Air Compressor

Technology	Reciprocating
Stage	Multistage
Motor power	Minimum 20 HP
Motor make	Crompton Greaves or Seimens or Kirloskar
Free Air delivery	40 cfm or higher
Dryer & Filters	Air drier with Pre and Post filters
Piston displacement	50 cfm
Maximum Working Pressure	400 Psi
Tank Capacity	Minimum 500 Ltrs
Pump Type	Oil free pump

Power source	3 Phase AC
Noise level	< 70 decibels (db)
Safety features	Should be available for Machine and Operator with valves, gauges, trip switch, over load relay switch, Auto on/off features, emergency stop, etc
Essential Accessories	Hose (50 Mtrs), Blow Gun – 1, Chuck – 1, Handheld pressure gauge – 1, plugs
Warranty	2 Years

12

### High Torque Overhead Mechanical Stirrer

Technology	Microprocessor Control Technology
Motor	Brushless DC Motor (Min.140 W)
Display	LED Screen display for rpm,time and torque
Speed Adjustment	Should be precise
Speed Transmission	Through switch
Chuck for	1 to 10 mm shaft
Speed range (rpm)	50 – 1250
Maximum Torque	700 Ncm or higher
Safety	Overload and Motor protection
Stirring Capacity	100 ltrs (of water)
Shaft diameter (mm)	2,5,10 (three shafts)
Shaft type	Hollow
Stirrer blades	minimum 3 configuration
Power supply	Single Phase 230 VAC

13

### FUEL CELL TEST SYSTEM AND HARDWARE

Make	Bidder to specify
Model	Bidder to specify
System	<p>A fuel cell test system suitable for both direct methanol fuel cell (DMFC) and proton exchange membrane fuel cell (PEMFC)</p> <p>Impedance analyzer (in-built) for electrochemical impedance spectroscopy and high frequency resistance. System should be able to measure all parameters including proton conductivity.</p> <p>Anode and cathode backpressure controller - standards</p> <p>PEMFC must be able to operate upto 180 °C with proper humidification control.</p>
Fuel cells hardware	DMFC: Single cell with active area 5 cm <sup>2</sup> ; and 3-cell stack with active area 25 cm <sup>2</sup> . for each cell.

	PEMFC: Single cell with active area 5 cm <sup>2</sup> ; and 3-cell stack with active area 25 cm <sup>2</sup> . for each cell.
Cell features	Thermocouple
	Nitrogen purge – for anode and cathode separately
	Current collectors
	Inbuilt Heater
	Thermal Chamber/jacket/heater for high temperature PEMFC cell.
	Cell should have all necessary provision for control of humidity, temperature, reactant inlet and outlet, Nitrogen gas purging; etc.
Operating temperature range	DMFC: 35 to 90 °C or more
	PEMFC: 35 to 180 °C
Electronic load	Max current range: 100A
	Max voltage : 20V
	Power: 125 W or more
Flow controllers	For anode, MFC (Hydrogen): flow range: 0-2000 SCCM or more
	For cathode, MFC (Oxygen gas and Air): flow range: 0-5000 SCCM or more
	For DMFC operation appropriate good quality peristaltic pump should be inbuilt with the system. Flow rate 0.1 ml/min to 60 ml/min
Humidification system	Humidification system for hydrogen and air with accurate control for operation of the cell at various humidity and temperatures. Anode & Cathode humidifiers with automatic water fill. Humidity and temperature curve to be provided for verification.
	Humidification room temperature to 95 °C or more for both DMFC and PEMFC.
	Optional Bypass of humidifier by computer controlled valve
Proton conductivity cells	The conductive cell with appropriate humidity chamber or any other advanced system which can measure the conductivity within fuel cell fixture of the bare membrane. Standard four-point-probe cell to measure the in-plane conductivity of various bare membranes (without MEA). Conductivity measurement should be performed in various environments of varying relative humidity (25-100%) and temperature (room temperature to 95 °C or better); leading to a more accurate assessment of membrane conductivity and resistance.

	Fuel cell system should have appropriate software for measurement of proton conductivity of various membranes
	Membrane Conductivity Cell/probe and system must have all the required hardware, connectors and adaptors for complete conductivity analysis demonstration at varying condition.
Safety features:	Interlocks with external safety alarm
	Safety features to include PLC controlled, alarm, nitrogen purge and emergency stop, and hydrogen leak detector.
	High-temperature alarm on each temperature controller
Computer	i7 8GB 21" 1Tb branded computer as per the requirement of software for fuel cell system
Softwares	Suitable softwares with licence to be included to perform all the fuel cell related analysis in the tender specifications
	Analysis: Open circuit voltage, Current scan, Voltage scan, Potential EIS, Constant load discharge, Constant voltage discharge, and AC Impedance measurement, Half cell potential etc.
	Optional Bypass of humidifier by computer controlled valve
	Preheater to avoid condensation, set temp thru software.
	Software must be user friendly for easy customisation and should be upgradable for life time.
	System should run continuously without any monitoring for durability test at least for 100 hr or more
	Interfacing between system and PC should have fast response with easy data monitoring and acquisition.
	System should provide with digital monitoring and controlling system for temperature, reactant flow rate, cell temperature, humidification, back pressure, stack monitoring, voltage, current, real time cell resistance, half cell voltage, individual cell potential etc.
Spares and accessories	Gaskets for anode and cathode ( for both PEMFC (high temperature) and DMFC (each 0.5 m <sup>2</sup> )
	Carbon cloth and carbon paper (30cm X 30cm - 2 No each)

	Catalysts for both anode (Pt/Ru/C 40/40/20%, 10g) and cathode (Pt/C 40/60%; 10g); and Nafion inomer solution (5% in aliphatic alcohol/water; 500 ) for electrode preparation)
	Digital Multimeter and other tool kit (electrical and mechanical) should be provided.
	Nafion 117 membrane 30cm X 30cm – 2 No.
	Air spray gun (with ultrafine nozzle) for electrodes preparation
	MEA with active area 5 cm <sup>2</sup> and 25 cm <sup>2</sup> for both PEMFC and DMFC respectively - 5 No. for each.
	Filled in Hydrogen, Oxygen, Air, and Nitrogen gas cylinder for system.
	System should have all necessary softwares and assesories for full demostation and commissing of fuel cell.
	System should supplied with all the necessary connectors, pressure gaues, tubing and other hardware for connection for H <sub>2</sub> , O <sub>2</sub> , Air, N <sub>2</sub> gases to the fuel cell system.
Certificates	Supplier should provide all Calibration certificates and data sheet related to electronic load, humidity, temperature, backpressure and flow controllers system.
Installation and 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
Technical support and service	Manufacturer should have established 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.
Warranty	Should provide atleast 3 years warranty for whole system.

Annual Comprehensive Maintenance Contract (ACMC) as optional	Vendor should quote for Annual Comprehensive Maintenance Contract for the whole system and accessories supplied after the completion of performance warranty period. Supplier has to provide service support within 48 hours. Calibration of the machine shall be a part of warranty and ACMC. It shall also be mandatory to perform calibration after every major repair or breakdown.
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14

### Transmission Electron Microscope

1.	Model	Bidder to specify
2.	Make	Bidder to Specify
3.	Electron source	Field Emission Gun (FEG) with High Voltage Supply Unit. Probe current should be $\geq 1.5$ nA/ 1 nm with beam current $\geq 75$ nA. (not varified)
4.	Vacuum system	Fully automatic Microscope should have oil free vacuum system Turbo Molecular Pump based fully Dry-Vacuum system for the TEM with all required backing pumps, high vacuum pumps and Ultra-High Vacuum Pumps, suitable Pressure Gauges, Compressors and Suitable Air/Water Chillers etc. required for TEM operation. FEG gun vacuum should be $<2 \times 10^{-7}$ Pa or better TEM column vacuum should be $<2 \times 10^{-6}$ Pa or better
5.	Accelerating Voltage	200 kV or better It should work at accelerating voltages upto 200 kV or better in step/continuous variable mode.
6.	Resolution and spot size	TEM mode: Point Resolution should be $\leq 0.25$ nm or better Lattice resolution should be $\leq 0.14$ nm or better STEM resolution should be $\leq 0.2$ nm or better These resolutions should be proved in our system.
7	Analysis Mode	EDS Analysis STEM-EDS Mapping (Point/Line /Area Mapping) 3D tomography
8	Magnification	TEM Magnification Range: 50x to 1,000,000x or better

8	Magnification	STEM Magnification : Range 150x to 15,00,00,000x or better
9	Imaging mode	<ul style="list-style-type: none"> <li>• Bright-Field (BF)</li> <li>• Dark-Field (DF)</li> <li>• High resolution Imaging</li> <li>• Selected-area electron diffraction (SAED)</li> <li>• Convergent-beam electron diffraction (CBED)</li> <li>• High angle annular dark field (HAADF)</li> <li>• STEM Imaging</li> </ul>
10	Specimen holder	<p>Single tilt holder: <math>\geq 70^\circ</math> : 1 No.</p> <p>Double tilt holder: <math>\geq 35^\circ</math> (Specimen Tilt Angle <math>\geq \pm 25^\circ</math>) : 1 No</p> <p>Single tilt Cryo-Holder (temperature down to <math>-170^\circ\text{C}</math>): 1 No with necessary liquid nitrogen pumping station and related essential accessories. (For liquid sample)</p> <p>Single-tilt multi-specimen holder (for grid size 3 mm).</p> <p>Tomography holder: 1 No.</p>
11	Specimen chamber	<p>X, Y movement range : <math>\geq \pm 1</math> mm or better</p> <p>Z movement range: <math>\geq \pm 0.20</math> mm</p> <p>5 Axis Eucentric Sample Stage or better.</p> <p>Drift <math>\leq 1</math> nm/minute with a standard holder</p> <p>Specimen grid size 3 mm</p>
12	Detectors	<p>STEM should be consisting of BF, DF and HAADF detectors.</p> <p>STEM imaging with high angle annular dark field (HAADF) detector with resolution: <math>\leq 0.2</math> nm or better</p> <p>EDS with SDD detector with total active area 60-80 mm<sup>2</sup> or higher.</p> <p>All Detectors should be supplied with software for data acquisition and analysis.</p> <p>Imaging in Z (atomic number) contrast mode should be possible.</p>
13	EDS: X-ray detector (Optional)	<p>Fully retractable/in-column Silicon Drift Detector for energy analysis of secondary X-rays for carrying quantification of elemental composition with suitable active area</p> <p>Detector resolution <math>\leq 129</math> eV or better</p> <p>Capability to detect elements with atomic number <math>\geq 5</math> (i.e. from B onwards) to Uranium</p> <p>Appropriate software to quantify the elemental composition in STEM and TEM modes and for elemental mapping.</p>
14	Lens system	Consisting of condenser lens, objective lens, Lorentz Lens, diffraction, intermediate and projection lenses

15	Cooling system	Close circuit, automatic temperature and flow rate controlled water cooled chillers
16	Camera	CMOS camera
		16 Mpixel (Or better) @ 25 (or better) fps with full resolution
		Camera should be suitable for step and variable accelerating voltage upto 200kV or better
		Output images should be compatible with other commercial image analysis software
17	Tomography	
18	Sample preparation tools (OPTIONAL)	Suitable Ultra-microtome with cryo attachment with all necessary accessories
19	Future upgradation	TEM should be upgradable
20	UPS	ONLINE UPS with power backup for at least 1 hour for smooth operation.
21	Consumables	Spares and Accessories: Under comprehensive (including FEG filaments) warranty of 3 years all necessary spares and consumable need to be included in the quote.
22	Equipment software	Full software package for TEM control, data acquisition, analysis and display.
		Software should be capable of image processing, EDS analysis; electron based imaging and selected area electron diffraction analysis.
		Upgradation of the software has to be supplied free of cost.
		Facility for recording specific specimen translation position as reference point in memory
23	Vibration Isolation Platform	Auto leveling, active, anti-Vibration system for chamber and electron column isolation is required.
		Preinstallation site visit for the same.
24	Calibration Standards:	All calibration standards traceable to SI Units for TEM and EDS
		Should provide standard TEM sample calibration accessories including resolution standards, magnification standards
25	Safety devices	Should provide all safety system Against power/water/vacuum failures including automated Field Emission filament Safety device.
		Three No.- one for TEM, one for EDS and one for storage and processing of images separately.
		All control, data acquisition, analysis and diagnostics software loaded and tested on the computer.

26	Computer Hardware	Latest, Branded (HP/IBM/DELL) PC with latest hardware and software configuration, the minimum features being the following: Processor: 3.2 GHz (or higher) Core i7/Xeon processor Memory: 16 GB (or higher) Internal Drives: 2 TB OS: All software used to operate the instrument, acquire and process the data should be based on 64-bit platform such as Win 10 or compatible. Software: All softwares used to operate the instrument, acquire and process the data should be pre-installed.
		32" (or higher) TFT monitors
		CD/DVD reader and writer combo
		All software should be upgradable free of cost.
27	Utility requirements	Suitable Chiller and compressor for the main equipment should be supplied
		Closed circuit automatic temperature and flow-rate controlled chiller
29	Installation, commissioning and training.	Pre-installation requirements such as room size, required power rating, gases (argon, N <sub>2</sub> ), AC etc. are to be clearly mentioned.
		Site inspection and qualification must be performed by vendor's authorized representative, well in advance of system delivery.
		Installation, complete interfacing of the system with its subsystems, and commissioning is to be carried out by the vendor's factory-trained engineers, followed by a demonstration of the system's performance to the user's complete satisfaction.
		Warranty: The instrument and accessories should have a minimum of 3 years of Comprehensive Warranty from the date of installation on the complete system, including all the subsystems. The comprehensive Warranty should cover: All parts including accessories and labor and Free maintenance and service with Regular up-gradation of softwares
		Onsite training: Onsite training to the researchers by the company person in two phases. First training for two weeks immediately after commissioning of the equipment and Second training for two weeks after two months of first training.
		Compliance statement to each item of this document to be provided along with the technical bid.

**CAPILLARY RHEOMETER**

1	Make	Bidder to specify
2	Model	Bidder to specify
3	Capillary Rheometer	Twin bore rheometer for rheological properties - R&D, advanced measurement capabilities under high pressure and high shear rate for plastics, polymer, rubber, composite, compound, recycled materials, ceramics, inks and coating.
4	Mesuring mode	Constant speed Constant pressure/ force
5	Piston	Lowest test speed: 0.005 mm/min or lower Maximun speed: 1000 mm/min or higher Dynamic speed ratio: 2,50,000:1 or better Independent load cell on each piston Advanced high resolution and accurate speed control system (vendor should furnish details of speed resolution and speed control system in details)
6	Barrel	2 Barrels system: 2x15mm bore diemeter Lenth: standard 290 for each barrel MOS: Hastelloy or equivalent corrosion resistant metals Barrles should be straight, smooth, without any tools mark. Barrels must be easily accessible for both feeding of test samples and also for cleaning after the testing. Each barrale should have three independet heating zone Cleaning device and accessories should be integrated for barrel cleaning at the end of each test. Should have inert gas purging unit for moisture and tempearature sensitive materialsr and to minimize sample degradation
7	Force	50 kN or better Accuracy :0.4% for whole range
8	Pressure transducer range	Pressure range : 0 to about 2000 Bar Accuracy: <0.5% Vendor should provide 02 sets of pressure transducers with max. pressure of about 50 bar, 200 bar,1000 bar and 2000 bar with 0.1 bar resolution
9	Temperature range and controll system	Ambient to 400 °C or more Temperature resolution: 0.1 °C Microprocessor based temperature control, heating rate should be in between 0.5 to 5.0 °C

		Should have at least three independent temperature zones
		Temperature accuracy: $\pm 0.2$ °C or better
10	Capillary dies	<p>MOS: Tungsten carbide</p> <p>A: (i) Dia: 1 mm, length 10 mm (ii) Dia: 1 mm, length 20 mm (iii) Dia: 1 mm, length 16 (iv) Orifice Dia: 1 mm, length: 0.25 mm; Vendor should also provide Orifice dies for every die dia. diameter for Baglay correction .</p> <p>B: (i) Dia: 1 mm, length 16 mm (ii)Dia: 1.5 mm, length 20 mm (iii) Dia: 0.5 mm, length 08 for wall slip</p> <p>Vendors should provide other dies as required to operate rheometer from lowest to highest shear rate for measurement of all rheological properties.</p>
11	Rheological properties measurements	<p>Vendor should provide all necessary accessories for following measurement options according to International standards:</p> <p>i). PVT</p> <p>ii). Dynamic and static laser die swell measurement</p> <p>iii). Shark-Skin (Flow instabilities)</p> <p>iv). Pressure dependence of viscosity (Measurement of pressure coefficient, wall slip's critical shear rate, Maximum pressure.); and Viscosity measurement</p> <p>v). Thermal conductivity (optional)</p> <p>vi). Extensional viscosity (Blown film, forms, spinning and coating materials)</p> <p>vii). Melt strength measurement (Fiber spinning materials)</p> <p>viii). Melt temperature determination</p> <p>ix). Melt cutting unit</p> <p>x) Constant shear test; extensional test; Die swell; Wall slip analysis; Melt fracture; thermal stability; Low speed degradation; Stress relaxation; Intrinsic melt viscosity; Viscosity dependent on temperature; Fitting equation for viscosity at zero shear rate and relaxation time etc.</p>
12	Standards	<p>ISO 17744 (PVT; Determination of specific volume of plastics as a function of temperature and pressure; measurement under constant pressure or constant temperature));</p> <p>ASTM D3835 (Measurement of melt viscosity, sensitivity or stability with respect to temperature and polymer dwell time; and die swell ratio, shear sensitivity when extruding under constant rate or stress);</p> <p>ASTM D5099 measurement of rheological characteristics of raw rubber</p>

		DIN 5930 (Thermal conductivity of plastics in the range from -40 to 400 C; conductivity range 0.08 to 2 W/m.K ; covering thermoplastics, thermosets, rubber and filled and reinforced)
		ISO 11443 (DIN 54811) (fluidity of plastics melt useful in determining melt viscosities from 10 Pa.S to 10 <sup>7</sup> Pa.S in extrusion shear rate of 1 S <sup>-1</sup> to 10 <sup>6</sup> S <sup>-1</sup> )
13	PC	Rheometer should be integrated with a branded PC, with latest processor (i7 and above), 3.0 GHz or higher, 8 GB RAM, 21" LCD/TFT color monitor, at-least 1.0 TB hard disk, CD/DVD writer, 2 serial, 1 parallel port, keyboard, branded scroll mouse and a ethernet port.
14	Softwares modules and features	<p>Vendors should provide licenced softwares with re-installation capability when required, full functionalities for measurement and analysis of following rheological properties :</p> <p>i). PVT</p> <p>ii). Dynamic and static laser die swell measurement</p> <p>iii). Shark-Skin (Flow instabilities)</p> <p>iv). Pressure dependence of viscosity (Measurement of pressure coefficient, wall slip's critical shear rate, Maximum pressure.); and Viscosity measurement with Slit Capillaries</p> <p>v). Thermal conductivity (OPTIONAL)</p> <p>vi). Extensional viscosity (Blown film, forms, spinning and coating materials)</p> <p>vii). Melt strength measurement (Fiber spinning materials)</p> <p>viii). Melt temperature determination</p> <p>Softwares module should be user-friendly with following capabilities:</p> <p>i). All operations such as parameter setting, test start, data acquisition and processing, saving and re-processing controlled through software</p> <p>ii). Online and real-time display should be for raw data signal (load/pressure) etc.</p> <p>iii). Should have automatic Rabinowitsch/Bagley/Hagenbach corrections and non-Newtonian index calculations with appropriate hardwares</p> <p>iv). Should be able to export raw data as well as processed data to excel or any other data management system.</p>

		v). Should be able to perform other calculations such as application of viscosity models (Cross, Cogswell or Carreau, etc.) to viscosity data or application of temperature shifts to data using some standard relations.
		vi). Should enable to feed in any shear rates (increasing/ decreasing/ arbitrary) for testing.
		vii). softwares must be capable of displaying raw data during experiment
15	Safety features	Protective cover, hood, limit and safety switches and any other required safety provisions must be in place.
16	Scope of supply	Vendors must provide separate complete list of accessories needed as per tender specification. It should include any other optional accessories.
17	Tool Kit	Vendor must provide complete tool kit for maintenance
18	Calibration	Vendor should provide Hand tools for: charging and cleaning barrel, scouring brush, Sample filling funnel, Die nut removal wrench, cleaning capillary dies, Go/No Go gauges, Barrel Bore Calibration kit etc. for easy operation and maintenance of rheometer.
19	Calibration	Vendor should furnish all certificates traceable to international standard for : force calibration, Pressure transducer calibration, temperature calibrations and dies dimension.
20	Documentation:	All Claims made by the vendor with regards to the above specifications should be supported by specification sheets / brochures / data available on company website. No claims with regards to laboratory data will be accepted.
		Complete original operating & service manual hardcopy along with softwares pack
		if any deviation in tender specification, vendor must clearly mention during compliance statement according to their quoted model
21	Warranty	Vendors should provide at least three years warranty of whole rheometer including temperature sensors, pressure transducers etc.
22	Reference materials	Reference Plastic material of Low Viscosity & High Viscosity -01 kg each

16

#### FE-SEM with EDAX and Gold & Platinum Sputtering Device

	Make/Model	Bidder to specify
	Applications	To study morphological features of polymers and multiphase polymer systems.

1	Electron Gun	I. Schottky Field Emitter with High brightness.
		II. Filament or its replacement must be provided for at least 3 years from the date of installation
2	Accelerating Voltage	200V to 30 kV or better (continuously adjustable)
3	Resolution	Resolution with in-beam/in-lens SE Detector
		• 0.7nm or better @ 15 KV
		• 1.0nm or better @ 1 KV
		The definition of resolution and the method used to determine the resolution should be clearly specified and resolution should be determined at the site of installation on standard gold on carbon sample at supplied accelerating voltage
4	Magnification	X20 (or lower) to 10,00,000X or better
5	Probe current	Suitable for all applications. Upto 100 nA
6	Imaging Modes	(i) SE, (ii) BSE
7	Detectors	SE detector, BSE detector and In-column or In-lens detector with beam deceleration (BD)
8	Vacuum System	I. Suitable vacuum systems having Ion getter Pump/sputter ion Pump, Turbo molecular Pump and Rotary Pump/Oil free/Dry Scroll Pump must be provided.
		II. All necessary gauges and valves must be included. Pump down time should be 5 minutes or less.
9	Chamber	I. Chamber should accommodate a sample size of 1.5 cmx 1.5cm or more.
		II. Minimum number sample Ports: 8 or more for future expansion
		III. Details of chamber dimensions to accommodate the above sample size for characterization should be clearly indicated
10	Sample stage	I. PC controlled 5 axis motorized stage. (X ~100mm, Y~80mm, Z=25 mm
		Tilt=0-60° R=360°
		II. Ease for specimen exchange.
		III. Stage movement should be controllable through both computer and manually with joystick.
11	Sample holder	For adding 8 or more 1 cm <sup>2</sup> samples
12	Camera	CCD camera with IR illumination for in chamber viewing
		I. Detector size/Chip size: 30 mm <sup>2</sup> or more
		II. Resolution: 129 eV or better@ Mn Ka
		III. LN2 Free, Peltier cooled detector
		IV. Detection from B(5) to U(92).

13	EDS system	V. Supplied EDS server and analysis software should be capable of performing data acquisition storing and transfer in common windows based application formats, qualitative & quantitative analysis, line scanning, elemental or dot mapping including spectrum imaging and phase mapping with specimen drift correction.
		VI. Standard samples for calibration should be provided.
		VII. Interactive ZAF/PB and Phi ρ z based quantification software with tilt correction and manual background correction and peak deconvolution as an integral part of the software.
14	Image Acquisition and display	I. 24-inch HD LCD or LED Screen: 02 no.
		II. Image size: 5120 X3840 pixel or better.
		III. Image depth: up to 16 bits or better
		IV. Image format: BMP, TIFF, JPEG, JPEG2000, GIF, PNG, etc.
		V. Software should be capable of automatic generation of report in MS-Office. MS-office be provided.
		VI. Image acquisition system should be compatible with Windows 10 or recent operating system version of windows.
15	Sputter Coater system	I. Sputter coater system: Metal Sputtering and Carbon coating system to be provided.
		II. Metal Target: Au, Pt, Au-Pd to be provided,
		III. Vacuum pump and other necessary items to be provided.
		IV. 01 set of additional/spare targets to be required.
16	Sample holders and consumable	I. Sample holders for 6-inch wafers – 2 Nos.
		II. Cross section and tilted sample holders – 5 Nos. each of 45° and 90°
		III. Pin/regular stubs 1 inch – 50 numbers
		IV. Conductive carbon adhesive tapes – 5 Nos.; (Length: 20 m; Width: 8mm – 1 No.; 10mm – 2 No.s; 20 mm – 1 Nos.; 50 mm – 1 No.)
		I. A filament replacement warranty card.
		II. Track ball for imaging operations/ Joystick/ Control panel
		III. Touch alarm safety detector for specimen stage and detectors.

17	Essential Accessories	IV. Remote control hardware & network software for on line fault diagnosis using internet TCP / IP open protocols.
		V. All essential commissioning and operating accessories like Air compressor, Chillers etc., to be provided
		VI. Essential tool kit to be provided
		VII. A suitable 10 KVA or more UPS for 1 Hour or more backup on full load to be provided
		VIII. Suitable printer
18	Data storage and analysis softwares	I. Suitable hardware and software for equipment control, data acquisition and analysis.
		II. No public domain software is acceptable. Manufacturer must offer their licensed software developed by them. Updates to the instrument control/data collection and automated structure solution and refinement software will be provided as available free of charge and in perpetuity.
19	Standard/ calibration samples	I. Standard samples such as Co, Mn, Gold magnification standard Faraday cup, a brass duplex standard for BSD calibration, etc. should be provided for calibration.
		II. All other optional standard samples may also be quoted as optional items
20	General	I. FESEM quoted must be compete in all respect with stage of art technology. It should have capability to image thin films, polymers, ceramics, semiconductors and magnetic specimen at high mag. FESEM should have suitable technology for optimum performance of all the detectors particularly In-Lens SEI.
		II. The quote should include all accessories required to image. Thin films, polymer, ceramics, semiconductor and magnetic samples.
		III. FESEM should include safety devices for protection against Failures in vacuum, water, power etc.
21	Installation and training	I. After installation one week of through training must be provided on site. Details should be indicated.
		II. Installation must include:
		a. Resolution check.
		b. EDS resolution check; 129 eV or better; Mn K $\alpha$ and also detecting B(5) to U(92).
		c. Operation using standard samples on all modes of imaging
		d. Elemental mapping, line scan, etc. in case of EDS

		III. Standard samples to require a certificate from standard certifying bodies
		IV. Complete set of manuals on operation, maintenance of the system in hard copy as well as soft copy should be provided in English.
22	Warranty	5 years comprehensive warranty should be quoted as standard

17

#### TORQUE RHEOMETER

	Make	Bidder to specify
	Model	Bidder to specify
	Applications	Machine could capable to study the following properties
		Viscosity, flow behaviour
		Compounding formulation and recycling of polymer
		Blend ratio
		Extrusion and injection moulding processability
		Morphology
		Influence of the screw design on the viscosity
	Temperature Range	ambient to 450°C
	Torque Range	150 Nm higher
	Rotor Type	Roller, Cam, Sigma and Banbury Rotor available
	Heating zones	4 or more
	Feed section	Air and water cooled
	Temperature controller	Electrical
	Screws	single and twin Parallel, Segmented – co-rotating
	Screw speed (rpm)	0-200 or higher
	Software	Suitable software for control / measurable parameters (torque, speed, temperature and time) evaluation, and materials response to be provided. Compatible to windows 10
	Overload protection	Electrical cut-off to be provided
	Feeding system	Manual and Pneumatic
	Peripheral devices	Extrudate cooling baths
		Blown film unit tower
		Feeders
		Pelletizers
		Melt pumps
	Heating & Cooling systems	Integrated heating & cooling systems to be provided
	Dies	Capable for producing profiles like flat films, sheet, blown films, rod and multi-strands, wires, filaments as well as screen life tests.
	Batch mixing Features	Conical type bowl and rotor in axial direction

	Accessories	Please quote for essential and optional accessories separately
	Work station ( computer)	i7 8GB 21" 1Tb branded workstation as per the requirement of software for equipment
	Operating system	Windows 10 original

18

**Gel Permeation Chromatography (GPC)**

	Make/Model	Bidder to specify
1	GPC	Gel Permeation Chromatography System with complete control of all components from computer is required for analysis of polymeric compounds. The system should have the following specification:
2	Standard	ASTM D6474 – 12, ASTM D 5296, ASTM D 6579 - 11(2015) (for hydrocarbon solvent)
3	Solvent Delivery system:	I. Isocratic Pump with on-line vacuum degasser.
		II. Operating pressure : 0 to 6000 psi
		III. Flow rate : 0.01 – 10.00 ml/min
		IV. Flow accuracy : $\pm 1\%$
4	Sampler	I. Suitable Manual Universal Injector system
		II. Auto-sampler
5	Molecular weight range	500 to 20,00,000 g/mol or better
7	Auto sampler	I. Injection programmable from 20 to 200ml
		II. Precision < 0.5 % RSD
		III. Minimum 100 vials of 1.0 ml or more capacity
8	Column Oven	I. Minimum two columns of suitable length along with guard column.
		II. The temperature range should be ambient to 80°C.
9	Detector systems	I. All the detectors should have provision for temperature control from 30 °C to 60 °C or more.
		II. Refractive Index Detector (Range 1.00 to 1.70 RIU) or better
		III. UV –Visible light Detector
		IV. Light Scattering Detector (should be equipped with 2 or more angles. One at right angle light scattering (RALS) & other at low angle light scattering (LALS)
10	Column	GPC standard columns along with Guard columns for organic, aqueous and mixed solvents.
		I. Branded PC with configuration windows 10 original software, i7, 1TB HDD, 19 inch TFT monitor and Laser printer should be supplied along with the instrument.

11	Computer and Software	II. Should provide validated software with single point control of the entire GPC system.
		III. Ability for GPC data handling, customizable data reports, report publisher and compatibility with RI, UVVis, DAD, RALS/LALS detectors etc.
		IV. The software should be able to perform conventional, universal and triple/tetra detection measurement and calculations Mn, Mw, Mz, Mp Mw/Mn etc.
		V. Original software CD with license with life-time validity should be provided. It should be GLP compliance and up-gradable.
12	Spares & Consumables	I. Solvent Filtration Kit (Aqueous and Organic) of Mol. Wt. range 500 to 2,000,000 Daltons, including vacuum pump, 1 litre Flask, Membrane filters, etc.
		II. Polystyrene standard kit (Mol. Wt range 500 to 2,000,000 Daltons),
		III. GPC standards for Polyethylene glycol (PEG), and Polysaccharides.
		IV. Sample extraction kits (SPE) for 1000 samples, molecular weight range 500 to 2,000,000 Daltons.
		V. Atleast 6 sets of 12 different molecular weight standards for low to high molecular weights for calibration of instrument and RALS/LALS detector. There should be traceability to the relevant certifications.
		VI. On-line sine wave UPS of minimum 5KVA rating with isolation transformer and 2 hour. backup facility of reputed brand. (Make & model of UPS should be furnished)
13	Installation and training	I. Vendor should visit the site and provide pre-installation requirement free of cost before installation.
		II. Free of Cost. Training should be given for staff and students.
		III. The entire system should be installed by the company professionals at our site. A thorough technical training (minimum 3 days) in analyzing and troubleshooting should be given by the technical professionals.
		IV. Complete set of manuals on operation, maintenance of the system in hard copy as well as soft copy should be provided in English.
14	Warranty	V. Minimum 5 Year full instrumentwarranty

1	Make	Bidders to specify
2	Model	Bidders to specify
3	<b><u>Modal shaker with power amplifier.</u></b>	
	Max. Force Sine/Random Conventional	150 N
	Max. Displacement(mm) peak- peak	12 mm
	Max. Acceleration	65g
	Table diameter	Ø 50 mm
	Maximum Load	5 Kgs
	Effective mass	0.4- 5 Kgs
	Frequency Range	5Hz – 5 kHz or better
	Excitation output	10-32 mounted stingers
	Max. operating current	≤10 amps
	Armature Coil resistance	2.8 Ω
	Mounting Hole(mm)	bidder to specify
	Power Amplifier	100W/200W
	Cooling	Natural Air cooled option.
	Vibration controller	Suitable for the above shaker
	The controller should have the following specifications	4 channels, built in power source for IEPE with a sampling frequency of upto 54Khz
	Software capabilities:	<b>Swept sine:</b>
		<b>Control Strategy:</b>
		Single Channel.
		Average.
		Maximum.
		Minimum.
		<b>Sweep Definition:</b>
		Number of Sweeps.
		Duration.
		Cycles
		<b>Sweep Direction:</b>
		a) Up only (in multiple sweeps).
		b) Down only (in multiple sweeps).
		Up and Down.
	Other software features	Sine, Random, Sine on Random etc.,
	<b><u>Dynamic Signal Analyzer,</u></b>	
	<b><u>(i) Hardware specification</u></b>	
	Portable all-in-one data acquisition system, rugged industrial design	
	Dynamic channels -4	
	Type of input connection- BNC	
	Universal analyser	
	Additional Speed/Trigger channels- 2	
	Output channel - 1	
	Sampling rate >100 Ks/s – 24 sigma delta ADC	
	Resolution – 24 bits(144 DB) input range at 1kHz - ±0.05 DB Temp variability - <0.1 DB / 10 degree C	
	Type of inputs - AC/DC/ICP/TEDS/FLOAT - ± 17.5 mV to ± 10 V	
	Dynamic range > 120 dB	
	Filters: High/Low pass- Stop/pass band – Integrator(Simple/double) – Differentiator – A/C/Z	

4	Frequency range - DC – 40kHz - $\pm 10$ V range
	64 X over sampled (upto 6.4 MHz) – resolution: $> 160$ ns $\pm 10$ V range
	1 Inbuilt force DSP
	Ac – 100 V to 240 V, DC – 10-28 V
	Interface -1 Gb/s Ethernet
	Maximum weight - 1.4 Kgs
	<b><u>(ii) Software specification</u></b>
	Software features:
	Graphical: Windows Management - Trace Management – Zoom & Translation – Scale management – Markers/Cursors
	Display: Time series – Narrow band – Profiles – View Meter – 3D
	Data Management: Setups – Load, save and recall workbook with Measurements – Save selected results and raw data automatically. Projects – Project manager tree – filters
	Project Manager
	Measurements – Save selected results and raw data automatically
	Real time analysis: Gap free recording – 4 ch; 40 kHz. Real time FFT – 4 ch
	Output/Generators: Pure tone – 1 independent fixed sine. Noises – 4 uncorrelated random
	Swept sine – 1 to 6 simultaneous outputs
	<b>Import/Export:</b> Signal import (time series) – OROS wav
	Result import (others) - AE2
	Export – UFF – TXT - SDF
	Report – MS WORD- Excel
	<b>Standard plug-in:</b> Bandwidths – 1 independent bandwidths
	Tracks – Upto 128 tracks
	Modes – Start to time – Start to stop
	<b>Narrow band spectra:</b> 401 lines (for 801, 1601, 3201, 6401 lines multiply requested SPU respectively by 1.25, 1.5, 2, 3)
	20 kHz bandwidth
	0% overlap
	1 channel processing = 1 SPU
	Bandwidths – DC to 20 kHz
	Averaging – Time, spectral
	Weighting window – Hanning- Hamming
	Filters – HP, LP
	Cross functions – Cross spectra
	Others – Adjustable band power tracking
5	<b><u>Modal Analysis Software (3D visual),</u></b>
	Basic geometry modelling ,display and revision of test data in time or frequency domain ,overall modal parameter identification of SIMO single frequency point in full frequency range ,Frequency based ODS 3D motion simulation ,3D simulation of modal shapes .
	<b><u>Tri-axial Accelerometer with connecting cable,</u></b>
	Built-in IEPE preamplifier Tri-axial (x,y,z) miniature accelerometer Single 4-pin Connector.
	Measuring Range: $\pm 700$ g
	Sensitivity : 10mV/g
	Frequency response, 0.5dB : 1 to 8,000 Hz
	Mounting Resonance Frequency : 40,000Hz
	Resolution 1-10,000Hz : 0.0001 g rms
	Maximum Transverse Sensitivity : $\leq 5$ %

6	Non-linearity :< 2%	
	Weight : Not more than 1 gram	
	Connector : Single 4 pin connector	
	Mounting provision : 10-32	
	Housing materials : Stainless steel	
	Seismic element : ceramic	
	Sensing geometry : shear	
	Sealing : welded hermetic	
	Excitation voltage: 18 to 28 VDC	
	Constant Excitation: 2 to 10 , typical 4 mA	
	Output impedance :<100	
	Output bias voltage : 10 to 14 VDC	
	Noise, 1 to 20,000Hz: <0.002	
	Shock limit , $\pm$ peak : 1000g	
	Temperature range, operating : -40 to +250 °F	
	Transient temperature : 0.01 g/°C	
	Base strain sensitivity : 0.0002 g/ $\mu$ e	
7	<b>Accessories</b>	
	Calibration certificate	
	10-32 mounting stud	
	Single 4 pin connector with 5meter length and 3 BNC male connector end.	
8	<b><u>Fixture with test specimen.</u></b>	
	Mechanical fixture for modal ,free and forced vibration setups , Cantilever test specimen for study of free and forced vibration.	
9	Any other accessories if available for better utilization	Bidder to specify and quote if any other accessories available /required for smooth running and better utilization of the machine.
10	Scope of supply	Bidder should submit complete scope of supply (Machine, standard accessories, Optional Accessories etc with make model) in the technical bid without price. Bidder should supply complete start up package including material necessary to prove the machine and provide training.
11	Installation requirements	Bidder to specify , pre-installation requirement
12	Installation & Training	Basic and Advanced training should be provided at no extra cost
		Also the required operation, maintenance and other reference manuals should be provided for getting quality output and longer trouble free life of machine.
13	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.
14	Manufacturer's credential	Should have sizable installations of same model worldwide and at least two same or similar models in India.

**3D Optical Blue Light Scanner**

1	Make	Bidder to specify
2	Model	Bidder to specify (Please attach the supporting documents like products and accessories catalog)
3	Application	Precise measurements to be carried out independently of environmental lighting conditions.
		Scanning must produces a high accuracy
		Improved measurement of complex surface, complete data on complex components with deep pockets /fine edges such as turbine blades, reducing the number of individual scans. It is portable and easy to transport at vendor site
4	Scanning light	Optical Blue LED light based 3D scanning system
5	Acquisition time	Less than 2 seconds
6	Life of LED bulb	Minimum 10,000 hours or above
7	Resolution	Dual Camera system 5 Mpix each
8	System accuracy	To be reported as per VDI for all Measuring / Scanning volumes.
		The System should be certified that it confirms to the above standard.
		Sphere spacing error for 500 mm, Field of View should be 30 micrometers or less – Certificate should be produced.
9	Measuring Area range	1 mm x1 mm to1500 mm x 1500 mm job size or better
11	Transport box & casing	Transport box and casing to be supplied.
12	Mounting and Handling system	Mounting and Handling system of Sensor by single person to be supplied.
		High Quality Studio Stand.
		10 meter sensor cables & Power supply
		Clamp sets
13	Guided pointers	The system should be equipped with guided pointers for visualizing the optimum measuring distance.
14	Field of View	The item should be supplied with accessories for FOV of <100 <350 mm (or better). System should be easy and simple to setup with the ability to change only the lenses – if necessary, for adapting for different fields of views (FOV). No manual setting of focus either at projector or camera.
15	Operating conditions	The instrument should be capable of operating at 10 to 35 deg C and Relative humidity 55% or less with no condensation.
16	Consumables	10 Sheets of targets and 20 bottles of Spray to be supplied.
17	UPS	UPS should support up-to one hour of operation time of scanner.

18	Scanning Software	Capable of free form digitizing software for reverse engineering, data filtering, scanning with variable density points etc.
		• Automatic and Manual scanning and Processing
		• Calibration Accuracy Check Display
		• Motion /Vibration display
		• Quality / Accuracy Check of scans display
19	Software for 3D Surface Generation & Inspection	Should have the ability to merge scanned data automatically without manual intervention
		Multiple Alignment to CAD
		Editing - Polygon creation / editing
		• Feature extraction -Feature extraction
		• Datum creation -Should facilitate datum creation
		• 3D analysis - Tolerance and deviation Computations
		• 2D analysis - Tolerance and deviation Computations for sections and surfaces
20	Laptop	• Report- Should be capable of Report generation and Graphics feedback
		• Inspection features - Should be able to measure and report all GD&T Parameters
		A laptop for Fixed/portable requirements with the following specifications minimum - with interface cables for connecting Scanner to Peripherals / Laptop to be supplied.
		• CPU - 64 Bit Intel i7 CPU or better
		• Display- 19" or better
		• RAM-32GB RAM or better
		• NVIDIA - NVIDIA Quadro 4000M with 4GB GDDR5
		• DVD - RW
21	Software License	• OS requirement - Windows 7 or better
		• Mouse - Cordless Optical
23	Technical updates	• Network Card - 1 GBPS
		All software should be PTB certified and perpetual License. Supply of software updates and also periodicals from the machine manufacturer till the warranty period.
24	Documentation	Availability of information on technical update such as updated software, case studies, feedback from other customers etc. for effective utilization of the system on a regular basis.
		• Operational Manual (User Manual)
		• Software Instruction Manual
		• Maintenance and troubleshooting Manual
		• Training Manual

24		<ul style="list-style-type: none"> <li>Installation and Commissioning</li> <li>Handling of accessories</li> <li>Software key (for operation, if any)</li> <li>Software CDs</li> </ul>
25	Calibration Plates	<ul style="list-style-type: none"> <li>Calibration Plate with International STD VDI Certification for all FoV</li> <li>Periodic calibration of the artefact during and subsequent to expiry of warranty at a periodicity of one year for a period of five years to be indicated.</li> </ul>
26	Any other Accessories	Any other Accessories, if available for better utilization - Bidder to specify and quote
27	System	The System shall be catalogued items from a company. All the relevant catalogues shall be enclosed in the technical bid.
28	Scope of supply	Attach list for scope of supply
29	Installation requirements	Bidder to specify , pre-installation requirement
30	Installation & Training	Basic and Advanced training should be provided a minimum 6 days
31	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.
32	Manufacturer's credential	Should have installations of same model worldwide and at least Three similar model sold in Private and Government sectors, Attach OLD PO's for REF

21	<b>Server</b>	
1	Make	Bidders to Specify
2	Model	Bidders to Specify(Please attach the supporting documents like products and accessories catalog)
3	Processor	2 Intel Xeon E5-2600 v4 Core: 6 core Clock Speed: 1.9 GHz or above Cache: 8MB Cache or higher
4	Chipset	Intel C610 series Chipset or better on OEM /Intel motherboard
5	Memory	32GB & upgradable 2133 MHz or above DDR4 or above
6	Graphics card	Nvidia Quadro K4200 Graphics card with dedicated 4GB Graphics
7	Hard Disk	4 Nos 4Tb Enterprise SATA 7.2K RPM
8	HDD bays	3.5" SAS, SATA, nearline SAS,SSD drives with optional flex bay
9	Optical Drive	DVD RW drive / SATA / Internal

10	RAID	RAID 0,1,5 +1GB CACHE
11	Networking	2 x 1GbE LOMs
12	Operating System	Microsoft Windows Server latest version
13	Security & Manageability	Hard Disk, BIOS Password,TPM 2.0,Virus protection for boot sector
14	Monitor	24" standard Monitor
15	Keyboard	OEM make standard Keyboard
16	Mouse	OEM make USB Optical Mouse
17	Form Factor	Minitower / Microtower (With Optimized thermal management, low-noise chassis and silent fans)
18	UPS	1000 VA / 230 V - APS or better
19	Accessories	Bidder to specify any other standard/optional accessories
20	Warranty	3 Years Onsite Warranty

22

**Name of software : CREO**

Sl. No.	Description	Minimum No. of Licenses
1	CREO Parametric 3D Modeling Software (academic version) with complete modules for training purpose.	20
<b><u>GENERAL TERMS &amp; CONDITIONS</u></b>		
a) The above Software should be supplied with latest versions		
b) The quote shall be supplied with reference to the module		
c) The Software should be supplied in DVD / CD media for latest windows OS		
d) The license must be perpetual		
e) Warranty & AMC : Bidder should specify the warranty period from the date of acceptance of installation and training .Also submit quote for AMC as option separately.		
f) The Installation and training will be the responsibility of the supplier		
g) During the above period of maintenance, any upgrades released will be supplied free of cost		
h) Training : 7- Days Training shall be provided at the site after installation		

23

**3-matic software for Light Weight Structure**

Sl. No.	Description	No. of Licenses
1	Latest Academic Research version 3-matic software for Light Weight Structure experience software with complete modules.	5
<b><u>GENERAL TERMS &amp; CONDITIONS</u></b>		
a) The above Software should be supplied with latest versions		
b) The quote shall be supplied with reference to the module		
c) The Software should be supplied in DVD / CD media for latest windows OS		
d) The license must be perpetual		
e) The Installation and training will be the responsibility of the supplier		

- f) During the above period of maintenance, any upgrades released will be supplied free of cost
- g) Training : 7- Days Training shall be provided at the site after installation

24

**CNC Milling with Simulator - Education Model**

1	Make	Bidder to specify
2	Model	Bidder to specify
3	<b>Axis Travel</b>	
3.1	X-Axis (mm)	400-425
3.2	Y-Axis (mm)	300-325
3.3	Z-Axis (mm)	250-300
4	<b>Feed</b>	
4.1	Rapid Feed rate (X, Y,Z Axes) (mm/min)	15000
4.2	Max. Cutting Feed (X, Y,Z Axes) (mm/min)	10000 or higher
5	<b>Spindle</b>	
5.1	Rating (KW)	5 or better
5.2	max. Spindle Speed (rpm)	8000 or higher (continuously variable)
5.3	Taper	BT40
6	<b>Accuracy</b>	
6.1	Positioning (μm)	10 or better
6.2	Repeatability (μm)	10 or better
7	<b>Control System</b>	
7.1	Controller	Fanuc / Siemens /or equivalent OEM (Latest with complete module)
7.2	Part Program Storage (GB)	Capable to store large CAM programs for continuous running
7.3	Programming Functions with editor	Complete online and offline Module
8	<b>Essential Accessories</b>	
8.1	Voltage stabilizer	Bidder to specify and quote suitable for the machine
8.2	Ultra Isolation transformer	Bidder to specify and quote suitable for the machine
8.3	Compressor	Bidder to specify and quote suitable for the machine
8.4	Automatic centralized lubrication system	Bidder to specify and quote suitable for the machine
8.5	Touch Probe	Bidder to specify and quote Branded quality Touch Probe
8.6	Tool holding devices	Bidder to specify and quote Set of Cutting Tools Holder for 50 mm Face mill - 1 No Collect Holder - 5 Nos Set of Collects - 3 to 25 mm Drill Chuck - 2 Nos Pull stud- 20 nos

8.7	Cutting Tools	Bidder to specify and quote Set of Cutting Tools Face mill cutter(with replaceable inserts) - Dia 50 mm Bull nose cutter (with replaceable inserts)- Dia 25 mm Bull nose cutter (with replaceable inserts)- Dia 16 mm carbide End Mill cutter (each one)- Dia. 3, 4, 5, 6, 8, 10 mm carbide Ball End Mill cutter (each one)- Dia. 3, 4, 5, 6, 8, 10 mm HSS Drills ( one set) - Dia. 1 to 20 mm Centre Drill- 3 Diff. Sizes
8.8	Clamping Kit	Bidder to specify and quote Set of clamping kits
8.9	Others	Ethernet, USB ports, RS-232C
8.10	Simulator	CNC programming and operation simulator - 5 Nos
9	Any other accessories if available for better utilization	Bidder to specify and quote if any other accessories available /required for smooth running and better utilization of the machine.
10	Scope of supply	Bidder should submit complete scope of supply (Machine, standard accessories, Optional Accessories etc with make model) in the technical bid without price. Bidder should supply complete start up package necessary to prove the machine and provide training.
11	Installation requirements	Bidder to specify , pre-installation requirement
12	Installation & Training	Basic and Advanced training should be provided. Also the required operation, maintenance and other reference manuals should be provided for getting quality output and longer trouble free life of machine.
13	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.
14	Manufacturer's/ Supplier credential	Should have sizable installations of same model worldwide and at least five same model in India.
15	Warranty and guarantee	The machine shall be guaranteed for at least Two years for replacement and service against any design, manufacturing and workmanship defects.

1	Make	Bidder to specify
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2	Model	Bidder to specify
3	Applications	To study surface morphology of polymers, nanoscale morphological features, phase transitions etc.
4	Instrument type	Latest technologically updated model
5	Scanning Features	The system should have Sample Scanning techniques and should capable of operating in tapping mode, contact mode and non-contact mode.
		A single scanner must used for large and small (nm range) area scanning
		Automated focus, Automatic Laser Alignment and tip approach
6	XY Scanner	Maximum scan range: 50 $\mu\text{m}$ $\times$ 50 $\mu\text{m}$ or more
		Minimum scan range: 200 nm $\times$ 200 nm or lower
		Drive resolution in XY 0.1 nm or Better under both open and close loop and high voltage
7	Z-Scanner	Max. height range: 15 $\mu\text{m}$ or more
		Drive resolution in Z: 0.1 nm or Better under both open and close loop and high voltage
		AFM scan head with Flexure-based electromagnetically/ Piezoactuated XY-scanner; Piezo-based Z-actuator; Optical Z-position sensor; Closed loop Z-control
8	Operation modes	Close loop XYZ scanner
		Liquid sample analysis mode
		Static mode
		Dynamic Force
		Lateral Force Microscopy
		Phase Contrast
		Magnetic Force Microscope (MFM)
		Electrostatic Force Microscope (EFM)
		Piezoresponse Force Microscopy (PFM)
		Kelvin Probe Force Microscopy (KPFM)
		Force Modulation and nano mechanical for quntitative
		Conductive AFM (C-AFM)
9	Probes/Tips	STM with all necessary accessories
		Electrochemical cell (optional)
		Nano indentation
		Appropriate Probe kit should be provided for all operational modes, with at least 10 tips for each kit.
		Vender must provide tips with diameter of 5 nm or less. All tips should have spring constant suitable for polymer and polymer composite samples.

9		Should provide cantilevers/probes and calibration standards that are supplied with the basic system.
		At least 20 nos of additional tips for non-contact and contact mode should be provided
		Mounted tips should be provided
10	Video camera	On-axis Optical Viewing System with video camera with 5MPixel or better
		System having top and side view camera are preferred.
		Objective lens focus 10x or better
11	Control Electronics	The AFM must have state-of-the-art controlled electronics and following inclusions:
		24 bit or more digital to analog converters for scan controlling XY and Z
		Electronic signal input should be of 24 Bit ADC with at least 4 high speed ADC/DAC channel
		Analog signal handling for minimum electronic noise
		X/Y/Z-Axis Position Measurement : 3 x 24Bit ADC, 200kHz or Better
		Analog signal input bandwidth : DC to 3MHz or Better
		Up to 4096x4096 data points or better, 24Bit Zoom In 8 acquisition channels
12	System Computer & Software	dynamic digital filters
		X/Y Sample slope correction and Over scan
		Latest branded PC with windows operating system and licenced software for the operation of the instrument.
		Software must be a single package for all modes and attachments with no need for additional software programs.
		Software package must include both image acquisition and data processing softwares with multiple licence.
		Automatic cantilever spring constant calibration. 2D Fast Fourier analysis, Plane-fit, High pass and low pass filters, Zoom in/out, Optional grid on images and curves Color bar completely user definable 2D and 3D height presentation etc.
		All software should be upgradable for lifetime.
13	Accessories	• Active vibration isolation: Highly compact active vibration isolation for the better measurement
		• Acoustic Enclosure: Provides acoustic isolation during measurements &also shields against light, electric and air flow disturbances

		<ul style="list-style-type: none"> <li>Translation (sample) Stage: Travel range: 15mm x 15mm x 15mm or more</li> </ul> Should provide standard reference samples for all operational modes
14	Optional Item	Sample support - 4 pcs. 0.25mm dia& 30cm length – 2No 1. Small Sample Heater Sample holder for heating samples. Materials selected for minimal drift Temperature range: Room temperature to +120 °C Diameter: 60 mm 2. Temperature Controller. Temperature resolution: 0.1 °C Additional Temperature Sensor: Thermocouple Type K 3. Environmental Control Chamber Allows measurement under controlled atmosphere (inert, dry, humid).
15	Installation & training	Training should be given for staff and students.
		The entire system should be installed by the company professionals at our site. A thorough technical training (minimum 7 days) in analysing and troubleshooting should be given by the technical professionals.
		Complete set of manuals on operation, maintenance of the system in hard copy as well as soft copy should be provided in English.
		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
16	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.

17	Annual Comprehensive Maintenance Contract (ACMC) as optional	Vendor should quote for Annual Comprehensive Maintenance Contract for the whole system and accessories supplied after the completion of performance warranty period. Supplier has to provide service support within 48 hours. Calibration of the machine shall be a part of warranty and ACMC. It shall also be mandatory to perform calibration after every major repair or breakdown.
	Warranty	2 years

26 **Universal Testing Machine (UTM) with Environmental Chamber**

	Make	Bidder to specify
	Model	Bidder to specify
1	Control System	Microprocessor controlled
2	Maximum Load Capacity	100 kN
2	Cross head Travel distance range	0.01 mm to 500 mm or higher
3	Horizontal daylight	Min. 400mm
4.3	Accuracy for Cross head speed	± 0.01 mm/min
5	Load cells	100 N, 1 kN, 10 kN & 100 kN
6	Load cell Accuracy	≤ 0.5 %
7	Grips & Fixtures	<p>Pneumatic and Mechanical</p> <p>Tensile (suitable for plastics, rubber, film and fibre) compression, flexural, and shear fixtures.</p> <p>All fixtures should be suitable for low temperature testing and can be accommodated in to environmental chamber</p> <p>Rigid plastics (self lock winch grip, opening up to 12mm), plastic/composite rod (upto 12 mm dia) woven sacks (50mm width), rubber, fibre/filament.</p>
8	Machine should Conform to standards	<p>Tensile: ASTM D 638, ASTM D 882, and ISO 527</p> <p>Flexural: ASTM D 790 and ISO - 178</p> <p>Compression: ASTM D 695</p> <p>Shear: ASTM D 732</p>
9	Extensometer	Advanced Video Camera Extensometer -Non Contact type linear and lateral Strain guage
10	Data Acquisition Rate:	24-bit resolution card with data acquisition rate of minimum 500 Hz simultaneously on load, extension, and strain channels.
11	Data Sampling Rate:	400kHz or better
12	Safety lock provisions	Limiting switch for cross head travel should be provided
	Software	(a) Software attached & data storage for sample test methods

13		(b) Software should automates data acquisition, machine control, analysis, and reporting for a wide range of test requirements.
		(c) In addition, data compilation and provision for stress relaxation and creep shall be provided as per relevant ASTM Standards
		(d) Window's based graphical user interface.
14	Essential Accessories	
14.1	Computer System	Computer with suitable configuration to support the software and colour bottled inkjet printers should be provided
14.2	Environmental Chamber	Environmental Conditioning Chamber temp. range : - 100° C to 300° C. Accessories related to cooling and heating should be provided
14.3	Any other accessories required	Bidder should quote and supply any other accessories effective and better utilization of machine.
15	Calibration certificate	Calibration certificate for load cells and extensometer traceable to National / International Standards should be provided
16	Scope of supply	Bidder should submit complete scope of supply (Machine, standard accessories, Optional Accessories etc with make model) in the technical bid without price. Bidder should supply complete start up package including material necessary to prove the machine and provide training.
17	Terms & Conditions	The bidder must have supplied machines at other Institutes in the past (a satisfactory performance certificate from those users may be solicited if needed). Bidder should submit complete contact details.
		Manufacturer of the supplied equipment must be ISO Certified
		Authorization Letter from OEM
		List of clients in last five years to be provided.
		Manufacture/Supplier should have sizable installations of same model worldwide and at least Fives in India.
18	INSTALLATION, COMMISSIONING AND TRAINING	
18.1	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.

18.2	Training and documentation	Minimum of 5 days training for five persons which includes basic & advanced level training. Training content and plan to be submitted. Training faculty must have adequate experience in this field.
		The vendor should supply the necessary manuals such as
		• Software instruction
		• Maintenance and trouble manual
		• Training
		• Installation and Commissioning
		• Handling of accessories
		• Software key (if any)
		• Software CDs
18.4	Technical support and service	Manufacturer should have established after sales & service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 48 hours of need. Technical support personnel must have adequate experience in this field. Technical support personnel details should be submitted. Name and address of the authorized service centre/ partner in India along with the certificate of authorization should be attached.

27

**REFRACTOMETER**

<b>Quantity</b>		01No
<b>Make, Model, Series &amp; Sr. No.</b>		To be specified by Bidder for all including accessories
<b>Purpose</b>		Capable to Measure Refractive Index and Abbe number for Solid and Liquid Samples at different wavelengths. The refractive index curve as a function of wavelength to be obtained.
<b>TECHNICAL SPECIFICATION</b>		
1	Refractive index range	1.3 to 1.7
2	Wavelength Range	450 nm to 1100 nm with suitable filters
3	Light Source	LED
4	Display	LCD
5	Interface	RS 232 with PC.
6	Accessories	Suitable attachments for solid, liquid and film samples, Spare lamp, Standard reference material with known refractive index for calibration

7	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>• Traceable NABL Calibration certificate for the Standard Reference Material.</li> <li>• Machine should come with all other essential accessories &amp; spares required for installation, commissioning &amp; Operation.</li> <li>• Onsite free operational Training</li> </ul>
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28

### Colour Spectrophotometer

NAME		Colour Spectrophotometer
QUANTITY		1
Make, Model, Series & Sr. No.		To be specified by Bidder for all including accessories
PURPOSES		To measure Colour , Yellowness Index as per various Indian and International standards.
APPLICABLE STANDARD		ASTM D1925, ASTM E313, ASTM D2244, ASTM E308, ASTM E1164, DIN 5033, JIS Z 8722, ISO 7724/1, CIE 15: 2004
MEASUREMENT PRINCIPLE		Dual beam spectrophotometer.
TECHNICAL SPECIFICATION		
SL. No	PARAMETERS	DETAILS
6	Light Source	Pulsed Xenon lamp filtered to approximate D65
7	Viewing Aperture	Large area view : 1.75 in. illuminated, 50 mm measured
		Small area view : 1.75in, 1.00in, 0.50in, 0.25in & 0.13 in illuminated
		2in., 1.20in, 0.70in, 0.40in, 0.20in, measured
8	Lens switching for LAV/SAV	Automatic
9	Spectral Range	400-700 nm
10	Resolution	<3nm
11	Effective Band width	10 nm equivalent triangular
12	Photometric range	0 - 150%
13	Photometric Resolution	0.003%
14	Light Source	Pulsed Xenon lamp, Filtered to approximate D65 daylight
15	Lamp life	1 billion flashes or better
16	Automatic UV Control	420nm cutoff filter for UV Control & UV Exclusion
17	Measurement Time	< 3 seconds; (except 3mm area < 10sec.)
		For white tile: $\Delta E^* < 0.09$ for 44mm (1.75 inch)

18	Calorimetric repeatability	For Blue denim tile: $\Delta E^* < 0.07$ for 44mm (1.75 inch)
19	Inter instrument agreement	$\Delta E^* < 0.15$ (Avg) for 44mm (1.75 in.) $\Delta E^* < 0.36$ (Max.) for 44 mm (1.75 in.) CIE Lab (max.)
20	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 etc Black Calibration light Trap Green Check Tile Suitable advanced software & manual
21	Color matching software to measure: L, a, b, $\Delta xyz$	Suitable advanced software inbuilt with instrument
22	Other Mandatory Accessories:	While supplying the Machine, the supplier should also provide the following items apart from above: • Branded PC (if required for operation) of best configuration with necessary software including software for colour matching & colour printer suitable for the instrument operation. • Basic tool Kit-01 set • Hard copies of Operational & Service Manual- 01 set • The Machines should come with all other essential accessories & spares (as per ASTM & ISO standards) required for installation, commissioning & operation. Onsite free operational Training

29

**CONTOUR CUTTER**

<b>Quantity</b>	01No
<b>Make, Model, Series &amp; Sr. No.</b>	To be specified by Bidder for all including accessories
<b>Reference Standard</b>	ASTM 638, ASTM D790-17, ASTM D5930-17, ASTM D257-14, ASTM D3039-17, ISO 294-1, 294-2, IS -14151 Part-1 Type-2 dumbbell, For Tensile specimen - ISO 527-2-2012, Parts-4 and 5, IS 12701 (Tensile and Flexural specimen), IS 4984-2016, IS 13360 (Part-5 sec 6) rectangular

<b>Purpose</b>		For preparation of test specimens out of thermoplastic (rigid) materials & composite sheets to be used for Testing as per various Standards.
<b>1</b>	Table size (LXD)	330 x 375 mm or equivalent
<b>2</b>	XYZ axes stroke	310 x 220 x 160 mm or equivalent.
<b>3</b>	XYZ axes movement resolution	3 µm or better
<b>4</b>	XYZ axes positioning repeatability	0.02 mm or better
<b>5</b>	Fraise head holder movement	Through a step motor and suitable dia.ball, screw without backlash, 5 mm pitch.
<b>6</b>	Max speed (mm/sec)	100
<b>7</b>	Fraise rotation speed (rpm)	8000 to 24000 set manually according to the material type
<b>8</b>	Shield opening safety lock	Timed door lock release.
<b>9</b>	Emergency stop	Red panic button (Mushroom type)
<b>10</b>	Voltage(V)	230
<b>11</b>	PC connection	series RS232
<b>12</b>	Dimensions	600 x 800 x 700mm or equivalent with safety shield closed (L x W x H) 600 x 850 x 900 mm or equivalent with safety shield open (L x W x H)
<b>13</b>	Other special features	<ul style="list-style-type: none"> <li>• Vacuum system for dust collection to be included</li> <li>• Set of cutter for various type of materials and for different type of finish</li> <li>• Speed control</li> <li>• Dimension control</li> </ul>
<b>14</b>	Personal Computer (PC)	A Personal Computer (PC) of reputed make (bidder need to mention the make & model while quoting) having latest configuration. All software shall be loaded in the hard disk with appropriate partitions. All original CDs/DVDs must be provided.
<b>15</b>	Other Mandatory Items	<ul style="list-style-type: none"> <li>• Hard copies of Operational &amp; Service Manual-01 set.</li> <li>• All templates as per standards mentioned above with traceable calibration certificates</li> <li>• Machine should come with all other essential accessories &amp; spares required for installation, commissioning &amp; operation</li> <li>• Onsite free operational Training</li> </ul>

**VIBRATION LEAKAGE TESTER**

Make		Bidder to Specify
Model		Bidder to Specify
<b>1</b>	Shall conform to	Standard IS 2798 Clause 6.2
	Capacity	For testing of containers upto 20 litres

2		Vibration table size 300mm x 300 mm (Approx)
3	Frequency	variable upto 8 Hz
4	Digital Accelerometer	0.5 to 1.1 g ( with calibration certificate )
5	Other Features	Spring loaded motorized vibration arrangement
		Digital display of Set frequency & Acceleration
		Variable frequency drive should be provided for variable speed
		Shall be suitable for replacing the frame on the vibration table for testing various products as desirable
Calibration certificate traceable to NIST should be provided for frequency and acceleration		

31

**GLOW WIRE TESTER**

1	Heating element:	Nickel/Chromium glow-wire (80:20), 4 mm dia, shaped as specified in standards
2	Temperature sensor:	Sheathed Cr/Al thermocouple, 0.5 or 1.0 mm dia, located in tight fitting pocket hole in glow-wire
3	Temperature range:	Ambient to 999.9°C adjustable
4	Temperature precision:	± 5°C
5	Max. output power:	1000W
6	Glow wire application time:	0.1- 999.9 sec
7	Sample loading	Test sample moves against glow-wire preloaded to 1.0 ± 0.2N
8	Sample carriage:	Automatic, motorised movement of test specimen
9	Power source:	220VAC 50/60Hz
10	Safety:	Emergency stop, PLC interlocks
11	Calibration	The clibration certificate for the parameters should be traceable to SI Units

32

**Hybrid Membrane Test Skid Suitable for Cross-Flow Cell, Spiral Wound module and Hollow fiber Module**

1	Applications	<p>Test skind must be suitable for following membranes testing in laboratory to measure permeability and separation efficiency using vaious wastewater stream including brackish and sea water:</p> <p>Testing of Flat sheet (UF, NF anf RO) membrane with precise pressure control from 2.5 bar to 55 bar</p> <p>Testing of spiral wound module of flat sheet membrane with prescise pressure control from 2.5 bar to 55 bar</p> <p>testing of HFM module with precise pressure control from 2.5 bar to 20 bar</p>
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2	Crossflow Cell	01 no. of Uniflow cross flow cell
		Entry/Exit Flow : Side Entry for In/Out flow
		Maximum Pressure : 69 bar (1000 psig)
		Maximum Working Pressure: 55 bar
		Maximum Temperature : 70 °C
		MOC : SS316
3	Dimensions of Cell and Active Area	Outer Dimensions about 12.7 cm x 10 cm x 8.3 cm
		Active Area Dimensions about 9.2 cm x 4.5 cm
		Slot depth 230 micron
		Support Membrane 20µm sintered stainless steel
		Active Membrane Area 42 cm <sup>2</sup>
		Cell Connection type: Quick release coupling with lock
		Support: resists torque
		Layout : Unibody Planar support to restrict movement
4	Spiral Wound Housing	01 no. spiral wound membrane testing housing; MOC: SS316
		Size : 1812 (1.8 inch dia x 12 inch long)
		Working Pressure range: 2.5 bar to 55 bar
		Maximum Temperature : 70 °C
		RO Element Quantity (Spiral Wound membrane): 1 Nos (should provide its salt rejection, permeability and operating pressure value)
		NF Element Quantity ((Spiral Wound membrane): 1 Nos (should provide its salt rejection, permeability and operating pressure value)
5	Hollow Fiber Cartridge and Housing for hollow fiber membrane testing	01 Nos. Housing for hollow fiber membrane testing
		Hollow fiber Cartridge Specification: Pore Size 0.1 Micron; Active Membrane area 0.8 m <sup>2</sup> ; Length 850 mm; Housing MOC- Plastic/ PP
6	Feed tank	01 Nos. Capacity : about 20 Liters SS316 tank with lid with coil for refrigerant
		Refrigeration/Cooling System for tank: 1 Nos
		Surface : SS316 Coil
		Compressor Make: Cruise/Multi or Similar
		Capacity: 1 ton
		Type: Air Cooled standalone chiller unit
		Coil : Copper
		Refrigerant: R-22 or Similar
	High Pressure Pump	Control : ± 2 deg C
		01 Nos., High Pressure, Low Vibration Diaphragm Pump
		Setup : Independent mounted pump & motor skid

7		Pump Type: Motor driven seal less diaphragm pump
		Coupling : Mechanical
		Flow rate/pressure: upto 9 LPM and should operate from 2.5 bar (for UF) to 55 bar (for RO)
		MOC : SS316 /Viton
8	Motor	01 Nos. Motor : 2 HP /1.5 KW
		Motor Details : TEFC Squirrel cage induction motor direct Mounted 1440 rpm suitable for 3 phase, 415V & 50 Hz with VFD
		Motor Make: Bharat Bijlee/ Siemens/Crompton or similar
9	Variable Frequency Drive (VFD)	01 Nos. VFD for 2 HP/1.5 KW 3 Phase Motor
		Make : ABB/Danfoss or similar
10	Pressure Gauges	As required Nos. for Flat sheet, Spiral Wound and Hollow fiber membranes testing, operating pressure range from 2.5 (for UF) bar to 55 bar (for RO)
		Make : FGB/Wika or similar Similar
11	Pressure Regulating valves	Flow control Valve As required; Pressure Rating: 2.5 bar to 55 bar
		Dial Size: 2.5 inch dial glycerin filled
		MOC : Contact Parts SS316 & Valve Head –Gun Metal /SS
12	Skid and piping	As required quantity/Nos of Piping; Skid MOC: SS316; Piping MOC : SS316/PTFE Braided Hose pipe
13	Temperature gauge	01 Nos. ; Dial Size : 2.5 inch
		Make : Broiltech or Similar
14	Safety valves	PRV/safety valves as required Nos. for Flat sheet, Spiral Wound and Hollow fiber membrane testing
		Operation : Liquid recycled backed in to tank
15	Control Panel	MOC : MS powder Coated Includes Accessories: On/Off button for drive motor, speed regulator for motor
16	Conductivity meter	01 nos. for measurement of feed and permeate concentration (independent unit)
		Range :0.05 $\mu$ S/cm to 50 mS/ cm
		Make and model and serial no. should be specified by supplier
	Others	System should be mounted on corrosion resistnace stand with trolly
		Hollow fiber membrane housing should have standard fitting to allow laboratory made module for testing
		Flat sheet membrane housing should have standard fitting to allow laboratory made module for testing

17		Supplier should demonstrate all membrane testing without any leakage and vibration of the system
		Appropriate tool box should be provided for daily membrane testing
		Supplier should provide all appropriate necessary tubing and fittings to operate system from 2.5 bar to 55 bar
		Supplier should provide complete and detail schematic technical drawing of hybrid test skid indicating all parts, fitting, piping, pressure regulator, testing skid, pump, tank etc.
		Supplier should provide complete technical support and necessary items for installation and commissioning of the system.
18	Warranty	Minimum 2 year

33

**Hollow Fiber Membrane Spinning Unit (pilot scale)**

1	Dope solution tank and system	Capacity: 1.5 liter useful volume
		MOC : Stainless steel 316 (solvent and corrosion resistant steel)
		Max pressure : 8 Bar with stand capacity
		Operating Pressure : 0-8 Bar
		With digital air pressure display and control
		With manual valve system for switching
		Max temp : 6 to 70 deg C with jacket system to maintain temp
		Digital display and control to maintain temp
		With Teflon tube to connect spinneret – length – 20 M
		Teflon tube size : OD : 6 mm x ID 4 mm
		Provision for compressed nitrogen gas to dope solution tank
		Thermostate for heating the vessel, connection piping (vessel to metering pump, and metering pump outlet to spinneret inlet piping connection) unit, with all necessary connection hoses and piping.
2	Dope solution metering pump (spin pump)	01 Nos. Metering pump, capacity 1.2 CC/ rev (or to be agreed upon)
		Metering pump drive, complete with frequency controlled synchronous motor, infinitely variable rpm between approx 2 and 40
		MOC : stainless steel 316
		With heating jacketed system for temp .
		Max temperature : 120 deg C ( Or as per requirement )

		Geared Motor : 460 Watt
3	Filter unit	<p>Filter unit for fine filtration of the spinning solution, complete with jacketed filter housing for one cleanable stainless steel filter element, micron rating 3 micron, filtering area app. 12 cm<sup>2</sup></p> <p>All necessary piping and connection to filter unit</p>
4	Bore fluid solution tank and system	<p>02 Nos. Capacity: 1.5 liter useful volume</p> <p>MOC : Stainless steel 316</p> <p>Max pressure : 4 Bar with stand capacity</p> <p>Operating Pressure : 0-2 Bar</p> <p>With digital air pressure display and control.</p> <p>With manual valve system for switching</p> <p>Max temp : 6 to 70 deg C with jacket system to maintain temp</p> <p>Digital Display and control to maintain temp.</p> <p>Bore fluid supply system should have pressure regulator, connection hose between regulator and tank, set of flexible connection hoses between bore solution tank , flow meter and spinneret holder.</p> <p>Provision for compressed nitrogen gas to bore solution tank</p> <p>Flow meter with needle valve for dosing bore fluid range 0.02 - 1/7 l/h</p> <p>With Teflon tube to connect spinneret – length – 20 M; Teflon tube size : OD : 6 mm x Id 4 mm or as standard required dimension and length</p>
5	System for pressurizing the Fluid	<p>System for both Bore fluid and dope tank</p> <p>Max pressure generation 70 PSI</p>
6	Spinneret Unit	<p>Single-component spinneret 01 Nos. of 55 mils OD x 32 mils ID</p> <p>Single component Spinneret 01 Nos. of 32 mils OD x 16 mils ID</p> <p>Bi-component spinneret 01 Nos. of 63 mils OD x 55 MD x 31.5 ID</p> <p>MOC SS 316;</p> <p>Bore entry: top,</p> <p>Dope solution (both) entry: Lateral</p> <p>MOC : Stainless steel : 316</p> <p>With complete attachment to Dope tank and bore fluid tank and stand</p> <p>Spinneret holder, jacketed for heating (6 to 70 deg C), for holding one spinneret (other spinneret designs incl. spinneret holder upon request), with support for height adjustment of the spinneret holder between about 5 mm and 400 mm above coagulation bath level</p> <p>Appropriate thermostat for heating and controlling spinneret temperature</p>

		Spinneret must be of very high quality having very smooth finishing without any machine/tool mark and capable of spinning HFM of very high quality
		Bi-component spinneret with Ø 63 mils OD x Ø 55 MD x Ø 31.5 ID; MOC SS 316; Bore entry top, Dope solution (both) entry: Lateral
		Spinneret should be supplied with appropriate and all necessary connections, seals and tubing and fitting.
Coagulation Bath		01 Nos.: Stainless steel (SS 316) coagulation tank, deep design for vertical thread path, alternatively to the shallow design, jacketed for heating and cooling, with height adjustable immersed idle change of direction roll of about 50 mm diameter with low friction ceramic hybrid bearings (or equivalent), wash water supply branch and overflow
		Dimensions about – 1200 mm x 350 x 800 mm (L x W x D)
		Heating arrangement upto 150°C with temperature control
		Filament guide roller Diameter : 50 mm x 150 mm- 3 nos
		MOC : Polypropylene
		Single heater heating system
		Heating arrangement upto 150°C with temperature control
		Digital display to maintain the bath temp
		Thermostat for heating and cooling, of appropriate capacity approx 4,000 Watt, with connection hoses to the heat exchanger coil at the coagulation tank
		Stainless steel take up roll unit, roll diameter about. 75 mm, with idle thread displacement roll, with frequency controlled synchronous motor, infinitely variable take up speed between about 2 and 25 m/min, complete with stainless steel support frame (connected to coagulation tank support i.e Thermostat for heating and cooling), stainless steel front cover and dripping trough.
		Provision for water drain (at bottom) and inlet (at bottom, counter flow to fiber spinning) in coagulation bath

7	Draw roller unit	Required nos. of Stainless steel take up roll units, roll diameter about. 75 mm, with idle thread displacement roll, with frequency controlled synchronous motor, infinitely variable take up speed between about 0 and 25 m/min, complete with stainless steel support frame (connected to coagulation tank support), stainless steel front cover and dripping trough.
8	Wash bath-	<p>01 Nos. Stainless steel wash bath tank, shallow design with inner electric heating coil, coil covered with protective removable perforated stainless steel sheet, tank dimensions about 900 mm length, 500 mm width and 130 mm height, wash liquid flow countercurrent, with supply distribution pipe and overflow</p> <p>Idle wash bath rolls, completely immersed in the wash bath tank with low friction ceramic hybrid bearings, roll length about 420 mm, roll diameter about 25 mm, one roll with adjustable inclination for displacement of the thread</p>
9	Take up roll unit	Required nos. of Stainless steel take up roll units, roll diameter about. 75 mm, with idle thread displacement roll, with frequency controlled synchronous motor, infinitely variable take up speed between about 0 and 25 m/min, complete with stainless steel support frame (connected to wash bath tank support), stainless steel front cover and dripping trough.
10	Technical drawing	Supplier should provide complete and detail schematic technical drawing of HFM spinning unit indicating all parts, fitting, piping, pressure regulator, testing skid, pupms, motors, tanks, valve, indicator, regulator, controller, spinneret etc.
	Winder	<p>Speed range 0 to 25 MPM with VFD</p> <p>Motorized thread guide to uniform wind of filament</p> <p>Single Bobbin : Size : 150 mm W x 400 mm Dia</p> <p>Geared motor driven system for easy operation</p> <p>With minimum Dipped in water : 2/3rd level</p>
11	Wetting system	Dip tank method of continuous wetting of fiber
12	Control panel unit	<p>Control panel section - HMI Touch screen (plc controlled) Make Schneider or equivalent with auto control of all parameter</p> <p>Drive consist by panel: 1 HP drive : 7 Nos : Make :Schneider or similar</p>

13	Others	Spinning machine should capable of producing HFM of commercial standard in continuous fashion
		Supplier should provide all necessary parameter indicators and controllers
		Supplier should fully demonstarate UF type HFM by using polysulfone, PVDF, PAN dope solution.
		Any technical issues with spinning unit should be resolved during installation, commisioning and demonstration.
		All parts of spinning must be of very good surface and inner finishing without any machining and tool marks
		Spinneret holder must be able to accommodate different spinneret design like bi-component spinneret, single-component spinneret of differint dimensions
		Supplier should provide any other component and system required for continuous prepration HFM
		Complete system must be stand alone unit with appropriate stand (SS 304) having movable trolly stand for different components of system such as coagulation bath, wash bath, etc.
14	Warranty	Minimum two-years

34

### Hybrid Forward Osmosis Test Skid for Flat Sheet and Hollow Fiber Membrane

1	Applications	This skid system should be to evaluate the performance of forward osmosis processes, for a pressure-driven flat sheet and hollow fiber membrane for processing water and wastewater, chemicals, pharmaceuticals, and radioactive waste, as well as removing organics and heavy metals from solutions.
2	Forward Osmosis (FO) Flat Sheet Membrane Cell	01 no. of Uniflow cross flow cell
		Entry/Exit Flow : Side Entry for In/Out flow
		Maximum Pressure : 7 bar (100 psig)
		Maximum operting Pressure: 0-5.5 bar
		Maximum Differential pressure : 0.1 bar
		Maximum Temperature : 70 °C
		MOC: Acetal
3	Dimensions of Cell and Membrane Active Area	Outer Dimensions about 12.7 cm x 10 cm x 8.3 cm
		Active Area of membrane: 9.2 cm x 4.5 cm (about 42 cm <sup>2</sup> )
		Slot depth 230 micron
		Cell Connection type: Push Fit fittings

4	Hollow Fiber Forward osmosis membrane Module	Make: Aquaporin Inside
		Aquaporin Inside Coating: on lumen side of fiber
		Active Area (Lumen side/ Shell side): 0.6 m <sup>2</sup>
		Inner diameter of fibers: 200 micron
		wall thickness : 35 micron
		Housing Material: Polycarbonate
		Module dimensions: 150 mm long, 50 mm in diameter
		Module connections: Lumen 1/4" Threaded female luer
5	Dimensions of Cell and Membrane Active Area	Qty 1 nos
		Outer Dimensions about 12.7 cm x 10 cm x 8.3 cm
		Active Area of membrane: 9.2 cm x 4.5 cm (about 42 cm <sup>2</sup> )
		Slot depth 230 micron
6	Peristaltic Pump	Cell Connection type: Push Fit fittings
		02 Nos.
		Feed and Draw Flow Rate should be controlled in the range of 3 lit to 60 LPH
		RPM : 25 to 250 (with direct digital display readout)
		M.O.C. of the pump Head: Outer Arm/ Rotor : Anodized Aluminum; Rollers: Four no's Carbon Filled Nylon
		No of Channels: One
		Enclosure: Powder Coated Aluminum
		Motor: Precise PWM based DC motor Drive
		Supply: 230v, 50Hz, Single phase AC
		Rotational Direction Change : Toggle switch
		Tubing: 3 & 6 mm ID with 3 mm wall thickness Braided
7	Pressure Gauge	Pump Speed control : Auto/ Manual Modes of speed variation with 3 digit seven segment LED display
		Accuracy : +/- 2%
8	Solution tank	02 Nos. Pressure Range : 0 to 5.5 Bar (with least count 0.1 bar)
9	Weighing balance	Feed solution tank 15 litre: 01 Nos
		Draw solution tank 15 litre: 01 Nos
10	Piping and fittings	02 Nos. Capacity : 0 to 10 kg with accuracy 1 gm or better
11	Skid	MOC : PP/ Plastic Piping and fitting as required
		MS powder coated Skid to mount Forward Osmosis Hollow Fiber Module and Accessories
	Others	System should be mounted on corrosion resistnace stand with trolley

12		Hollow fiber membrane housing should have standard fitting to allow laboratory made module for testing
		System should be capable of operating at given flow rate and pressure with accuracy
		Supplier should demonstrate all membrane testing without any leakage and vibration of the system
		Appropriate tool box should be provided for daily membrane testing
		Supplier should provide all appropriate necessary tubing and fittings to operate system from 0 bar to 5.5 bar
		Supplier should provide complete and detail schematic technical drawing of hybrid FO membrane test skid indicating all parts, fitting, piping, pressure regulator, testing skid, pump, tank etc.
		Supplier should provide complete technical support and necessary items for installation and commissioning of the system.
	Warranty	Minimum 2 year

35

**3D printer - High Temperature Materials**

	<b>MACHINE</b>	
	Make	Bidder to specify
	Model	Bidder to specify
	Technology	Solid based production additive manufacturing system based on Material Extrusion technology, capable of producing parts for high temperature and strength application.
	Machine Capability	Should be able to build high strength, high performance and high temperature and medical grade materials. Provision for inclusion of new materials developed by R&D.
	Minimum Build Volume (X, Y, Z)	200 mm x 170 mm x 150 mm (maximum allowable deviation 10%)
	Layer Thickness	Minimum horizontal build layer thickness 0.1 mm or better Greater/lesser than 0.1 mm can be quoted as additional features.
	Part accuracy (in all three directions)	+/- 0.1 mm or better
	Material Handling	Material handling systems should be part of the Printer with automatic material loading, feeding and storage management system. At any instance of the machine operation during idle or run time, the machine shall indicate the quantity of material available in the spool / cartridge for optimizing the material consumption.
	Operation and Process	Controlled Chamber temperature

		Material extruding nozzles should have self-cleaning mechanism
		Auto calibration of build platform for coordinates.
		Auto and manual calibration of offset between model and support nozzle.
	Display Feature	Printing status, Material in cartridge, Temperature of chamber and print head/nozzle etc..
	Part building	Direct printing on base plate
	Facility Requirements	Machine compatible of working in office/lab environments setup.
		Noise level of the machine at the lowest level preferably 70 decibels. Relevant documentation/test results to be provided.
	<b>MATERIAL</b>	
	Model Material	<p>Suitable Materials for medical, aerospace and other high performance engineering application. PEEK, Medical grade PEEK, CFR PEEK, PEI and metals.</p> <p>Medical grade material should be biocompatibility and sterilisation properties and Confirming ISO 10993 or equivalent standard.</p>
	<b>SOFTWARE</b>	
	Slicing and control	Software should capable to edit the internal structure of each layer and/or group of layers of the CAD model.
		Software should generate customizable build styles
		Software should provide real time part build status, time etc.
		Software should have capability to section large parts which does not fit into the build volume
		Software should be able to create stabilizing structures to support build of thin and tall geometries. And ability to put supporting structures to prevent warpage in case of large flat and bulky parts.
		Software allow the user to add various jobs to a queue for sequencing and job management
		Software should have ability to pre-program pauses on any layer of the generated slice file to add metal inserts, change color of filament.
		Software and its support/updates/upgrades should be from OEM/manufacture of the offered machine.
	License	License must be perpetual
	Networks Connectivity	10/100 base T connection. Ethernet protocol
	Workstation Compatibility	Compatible with latest Windows OS

	Regulatory Compliance	Machine should be Regulatory Compliance - CE / FCC Relevant documentation to be attached.
	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.
	<b>Essential Accessories</b>	
	Support removing system	Bidder should specify and quote as per the requirement
	Consumables	Bidder should supply minimum quantities of consumables like build platforms, wiper blade, brush etc., required for 6 months. Also bidder should supply minimum quantity of model material each type 10 Canisters and support material each type 05 Canisters. Minimum two sets of Nozzles for different layer thickness minimum to maximum for all types of materials.
	Compressor	Bidder should supply suitable compressor with dryer and filter units along with the machine, the compressor should have an air storage capacity that support the machine and its accessories for at least 1 hr at the time of power failure.
	De-humidifier	Vendor should supply suitable de-humidifier to maintain room humidity level within suitable range for machine operation.
	Filament Dryer	Bidder to specify and quote suitable system for drying the filament
	Sintering & De-binding station	Bidder to specify and quote suitable system for printing of metal parts
	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.
	Workstation with accessories	Bidder should supply suitable latest model OEM workstation with complete accessories and UPS for handling large size STL data (128 GB RAM, i7 or higher processor, Hard disk 5TB, 4GB dedicated Graphics card)
	Tool kit	Bidder should supply standard tool kit for startup, removal of parts and cleaning (list to be attached).

	Any other accessories required	Bidder should quote and supply any other accessories for high speed printing, material transport trolleys / carts and spares required for effective and better utilization of machine.
	Scope of supply	Bidder should submit complete scope of supply (Machine, standard accessories, Optional Accessories etc with make model) in the technical bid without price. Bidder should supply complete start up package including material necessary to prove the machine and provide training.
	Terms & Conditions	The bidder must have supplied machines at other Institutes in the past (a satisfactory performance certificate from those users may be solicited if needed). Bidder should submit complete contact details.
		Manufacturer of the supplied equipment must be ISO Certified
		Authorization Letter from OEM
		List of clients in last five years to be provided.
		Manufacture/Supplier should have sizable installations of same model worldwide and at least Fives in India.
	<b>INSTALLATION, COMMISSIONING AND TRAINING</b>	
	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.
	Training and documentation	Minimum of 5 days training for five persons which includes basic & advanced level training. Training content and plan to be submitted. Training faculty must have adequate experience in this field.
		The vendor should supply the necessary manuals such as
		• Software instruction
		• Maintenance and trouble manual
		• Training
		• Installation and Commissioning
		• Handling of accessories
		• Software key (if any)
		• Software CDs

	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.
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36

**TWIN SCREW Compounder**

MODEL :		
1	Extruder	- Multi purpose co-rotating parallel twin screw - Segmental type with venting
2	Screw Dia - mm	15-20
3	L/D Ratio	40-44
4	Torque - NM	28-32
5	Materials	All thermo plastics
6	Output - Kg/hr	5-15 kg/hr
7	Screw speed - RPM	600-1200
8	Temp.- Deg C	Upto 400
9	Feeding system	One Spherical Twin screw volumetric main feeder with one side feeder.
10	Down stream equipments	Air dryer, Pelletizer, water bath High Speed mixer
11	Strand die	Dia of 2mm & 3 nos. of holes material: 33CrMoAIA
12	Stainless Steel Cooling Trough	SS 304 Stainless steel tank - 1.5m L 3 roller sets.
13	Strand Pelletizer (Synchronized cutter to be incorporated for Strand.)	Please specify
14	Standard Accessories	Please specify
15	Mixing elements & others	Please specify
16	Control- Microprocessor type	PLC based Touch screen automation Micropocessor With disply of Screw Torque & die Head Melt Pressure Please specify
17	Safety	Appropriate safety features to be provided
18	Computer connecting, data storage, & Analysis	Please specify
19	Melt Pressure and Temperature sensors	Please specify
20	M/c dimension	Please specify
21	Total Connected load - KW	Please specify
22	Spares	Please specify and quote seperately
23	Optional Accessories / Attachments	Please specify & quote seperately

**Stereolithographic Apparatus (SLA)**

1	Processing Unit	
1.1	Make	Bidder to specify
1.2	Model	Bidder to specify (Please attach the supporting documents like products and accessories catalog)
1.3	Technology	Liquid based additive manufacturing system based on Stereo lithography process
1.4	Minimum Build Volume (X. Y, Z)	600 mm x 600 mm x 400 mm or bigger
1.5	Resin Vat	Resin VAT with in-built heating module and interchangeable VAT mechanism
1.6	Process Chamber	Automatic resin level sensor, resin heating and recoater 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	Diode pumped Solid state laser Nd:YVO4 with 355nm wave length or Better/equivalent
		Laser power 3000mW or better
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 achieve better surface quality and faster productivity. The scanning speed should be 6 m/s to 10 m/s or better
1.14	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
2	Material	
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..) and submit quote separately for each materials as option.
		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
3	Software	
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
4	Essential Accessories	
4.1	Curing Chamber	Bidder should specify and quote suitable post curing chamber
4.2	Interchangeable Material tray	Bidder should specify and quote additional resin VAT with lifting system with required accessories
4.3	Sand Blaster	Bidder should specify and quote
4.4	Support removal	Bidder should specify and include 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 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.
4.7	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 specify and quote

4.9	Tool kit	Vendor should supply standard tool kit for startup, removal of parts and cleaning (list to be attached).
5	Optional Accessories	
5.1	Design, Analysis & Optimisation software (Research Version & License must be perpetual) - Bidder must quote AMC cost separately for each items	Solid Works - Design complete module Ansa with all modules COMPRO Simulation with all modules Digital Image Correlation – 3D Motion Analysis (Hardware & Software)
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
6	Other essential requirements	
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 10 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
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.
7	Installation, Commissioning and Training	
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	Minimum of 5 days training for five persons which includes basic & advanced level training. Training content and plan to be submitted. Training faculty must have adequate experience in this field.
		The vendor should supply the necessary manuals such as
		• Software instruction
		• Maintenance and trouble manual
		• Training
		• Installation and Commissioning
		• Handling of accessories
		• Software key (if any)
7.3	Warranty	Bidder to specify the warranty period. The whole system and its accessories should be in warranty for replacement and service against any design, manufacturing and workmanship defects from the date of installation and commissioning.
7.4	Technical support and service	Manufacturer should have established after sales & service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 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.
7.5	Annual Comprehensive Maintenance Contract (ACMC) as optional	Vendor should quote for Annual Comprehensive Maintenance Contract for the whole system and accessories supplied after the completion of performance warranty period. Supplier has to provide service support within 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.

38

**Particle Size Analyzer**

1	<b>Make</b>	<b>Bidder to specify</b>
2	<b>Model</b>	<b>Bidder to specify</b>
3	Applications	Particle size; Zeta potential; Molecular mass; Second Virial coefficient; colloidal suspensions, emulsions & dispersions; nanoparticles, Ceramic nano, Nanoscience applications; Particle size distribution. Should be able to measure zeta potentials of coatings as well as powders in dispersed state

4	Mode of operation	Wet mode
5	Capabilities	Machine should be capable of analyzing Particle size and distribution (static/dynamic light scattering), Electrophoretic light scattering-Zeta Potential and Second Virial Coefficient, Molecular mass, Polydispersity Index
6	Laser	Red/Green Laser with suitable source, He-Ne gas Laser/Semiconductor Laser
7	Size range	Particle size: Minimum detection: 0.3 nm to 10 $\mu$ m or better Zeta Potential: 5 nm to 100 $\mu$ m or better (with potential range of -500 to +500 mV)
8	Molecular weight range	min $2 \times 10^3$ to $2 \times 10^7$ Da
9	Conducivity	200 mS/cm or higher
10	Control system	Automated measurement
11	Volume units	User Exchangeable volume units
12	Laser power	Power of light source must be minimum of 8mW
13	Detectors	APD/PMT; High resolution photo diode
14	Data display and interpretation	Data display and interpretation unit must have the facility to generate reports like size distributions, density distributions, cumulative distribution, percentages, tabular, logarithmic, normal distributions, etc. The computer system should capable of showing good quality high resolution images along with a laser printer
15	Angular Type	Minimum two fixed angles or backscattered angle
16	Cuvette Type	Disposable (min. 1000 nos.), reusable and organic solvent compatible (min. 2 pairs), Zeta Potential quartz (min. 20 nos), PS cuvette (min. 100 nos)
17	Time	Measurement time min. 30 ns or better
18	Operating temperature	System should be capable of taking measurement from 0° to 90°C temperature or higher
19	Software	Software should run stand-alone for off-line data analysis and other measurements, with guaranteed protection of original measurement data. Real time display of particle size. measure Zeta Potential, Molecular weight, and static/dynamic light scattering, Second Virial Coefficient Statistical analysis etc. The software should be compatible with MS windows operating systems. The ability to export raw data and also to allow recalculation of measurement data by varying user input parameters. The software must be perfectual.
20	<b>Essential Aecessories</b>	

20.1	Vacuum cleaner	Bidder should specify and quote suitable systems with full details
20.2	Air compressor	
20.3	Computer with ups & Printer	
20.4	UPS for the machine	
20.5	Consumables/Spares	
21	Any other options	Bidder to specify and quote if any other accessories available /required for smooth running of the equipment
22	Terms & Conditions	<p>The bidder must have supplied machines at other Institutes in the past (a satisfactory performance certificate from those users may be solicited if needed). Bidder should submit complete contact details.</p> <p>Manufacturer of the supplied equipment must be ISO Certified</p> <p>Authorization Letter from OEM</p> <p>List of clients in last five years to be provided.</p> <p>Manufacture/Supplier should have sizable installations of same model worldwide and at least Five in India.</p>
23	Scope of supply	Bidder should submit complete scope of supply (Equipment, standard accessories, Optional Accessories, etc. with make model) in the technical bid. Bidder should supply complete start up package necessary and provide training.
24	<b>INSTALLATION, COMMISSIONING AND TRAINING</b>	
24.1	Installation and 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.
24.2	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>

24.3	Warranty	Bidder to specify the warranty period. The whole system and its accessories should be in warranty for replacement and service against any design, manufacturing and workmanship defects from the date of installation and commissioning.
24.4	Technical support and service	Manufacturer should have established after sales & service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 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.
24.5	Annual Comprehensive Maintenance Contract (ACMC) as optional	Vendor should quote for Annual Comprehensive Maintenance Contract for the whole system and accessories supplied after the completion of performance warranty period. Supplier has to provide service support within 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.

39

### Linear Height Master ( 2D measurement System)

The Digital Height Gauge should be capable of measuring all kinds of Geometric and Form Measurements		
	Make	Bidder to specify
	Model	Bidder to specify
1	Measuring Range - mm	600-700
2	Resolution - $\mu\text{m}$	0.1 or better
3	Repeatability	
3.1	on Plane / Surface - $\mu\text{m}$	2 or better
3.2	on Arc / Diameter - $\mu\text{m}$	3 or better
4	Maximum Permissible errors ( Values valid with standard Ball Probe at temp. of $20^{\circ}\text{C} \pm 0.5^{\circ}\text{C}$ ) - $\mu\text{m}$	$3+ L/300$ ( L in mm) or better
5	Perpendicularity Error - $\mu\text{m}$	10 or better
6	Drive method, Guiding Method	Motorized ( eable to operate by Manual also), Roller Bearing
7	<b>Probes</b>	
7.1	Hardened steel Ball Probes	One set of Dia. 1 mm , Dia. 2 mm , Dia .3 mm , Dia. 4 mm , Dia. 5 mm , Dia. 6 mm , Dia .7 mm , Dia. 8 mm , Dia. 9 mm , Dia. 10 mm each has height 100 mm (or) std. height as suitable for the probe holder.

7.2	Hardened Steel Disc Probes	One set of Dia. 5 mm , Dia . 10 mm ,Dia.15 mm and Dia. 20 mm each has height 100 mm (or) std. height as suitable for the probe holder.
7.3	Hardened Steel Cone Probes	One set of Dia. 8 mm , Dia . 16 mm and Dia. 20 mm each has height 100 mm (or) std. height as suitable for the probe holder
7.4	Hardened Steel Shaft Probes	One set of Suitable Shaft Probes to measure Grooves, Centring Shoulders and Blind bores having Probe inserts with a shank, Rod angle 80 and cylindrical rod,
7.5	Hardened Steel Cylindrical Probes	One set of Dia. 2 mm and Dia . 10 mm each has height 100 mm (or) std. height as suitable for the probe holder
7.6	Probe Holders	One set of Dia. 6 mm having depth up to 100 mm and depth up to 180 (or) 200 mm ,
7.7	Adapters for Probes	One set of suitable Adapters for Probes
8	<b>Essential Accessories</b>	
8.1	Data management accessories	(a) Data software
8.2	Electrical Supply Accessories	(a) Battery Block
8.3	Protection systems	Cleaning Liquid and Dust Covers
8.4	Input & Output accessories	USB , RS 232 Output , USB for pendrive Input , LCD TFT Display and Remote Keyboard etc.
8.5	Squareness Probe set	Squareness Probe set with built-in linear Encoder - 1 No.
8.6	Setting Master piece	Setting Master piece of Height 40 mm and 250 mm - 1 No.
8.7	Probe set box	Universal Probe set box - 1No;
8.8	Precision Granite Surface Table	Approximate Size 1600 x 800 mm with standard height
9	Others	Bidder to specify and quote if any other accessories available /required for smooth running of the equipment
10	Terms & Conditions	The bidder must have supplied machines at other Institutes in the past (a satisfactory performance certificate from those users may be solicited if needed). Bidder should submit complete contact details.
		Manufacturer of the supplied equipment must be ISO Certified
		Authorization Letter from OEM
		List of clients in last five years to be provided.
		Manufacturer/Supplier should have sizable installations of same model worldwide and at least Fives in India.
11	Scope of supply	Bidder should submit complete scope of supply (Equipment, standard accessories, Optional Accessories etc with make model) in the technical bid without price. Bidder should supply complete start up package necessary to prove the machine and provide training.

12	<b>INSTALLATION, COMMISSIONING AND TRAINING</b>	
12.1	Installation and 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> <li>• Software CDs</li> </ul>
12.3	Warranty	Bidder to specify the warranty period. The whole system and its accessories should be in warranty for replacement and service against any design, manufacturing and workmanship defects from the date of installation and commissioning.
12.4	Technical support and service	Manufacturer should have established after sales & service network in India. The vendor shall have local service and application office and infrastructure to attend by visit within 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.
12.5	Annual Comprehensive Maintenance Contract (ACMC) as optional	Vendor should quote for Annual Comprehensive Maintenance Contract for the whole system and accessories supplied after the completion of performance warranty period. Supplier has to provide service support within 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