Technical Specification for R & D Equipments, S. No. 16 to 30

S. No.	Name of the equipment & Technical Specification	
16	**Hammer Mill**	
	Technology:	Rotor milling hammers tools
	Type of material hammered	Materials: This milling machine is used to crush scrap metal (steel, iron, aluminium), household appliances, electronic waste, circuit board, gypsum board, etc.
		Rotor diameter: 850 – 1000 mm or equivalent
		Working width: 2500– 3000 mm or equivalent
	Technical Specifications	Output- 500kg/hr or better
		Control Panel- Cutler Hammer or any suitable panel
	Power	220 V, 3 Phase

17	**Micro processor controlled Automatic INJECTION MOLDING MACHINE**	
	Clamping Unit	
	Clamp Force (Tons):	275- 300 T
	Mould Opening Stroke	500 mm and above
	Maximum daylight	1000 mm or above
	Ejector Stroke	150 mm and above with appropriate ejector pins
	Ejector Force	2 Ton or higher
	Minimum, mould Thickness	200-230 mm
	Platen dimension	800 x 800 mm or above
	Tie bar distance	550 x 550 mm or above
	Other Requirements	· Optimized toggle mechanism to stabilize the running of
		· the moving platen
		· Low pressure clamping protection
		· Optical encoder Precise positioning control
	Injection Unit	
	Injection & plasticization System	Pre-plasticizing
	Screw Diameter	60-75 mm or equivalent
	Max. Injection Pressure	220-250 MPa

	Shot weight	800 gram or above
	Screw Speed (rpm)	minimum 200
	Injection Speed	180 mm/sec or higher
	Other Requirements	· Optical encoder or equivalent system for precise positioning control
		· 5 Stage injection speed
		· Min5 Stage injection pressure15 stage
		· Min2 Stage holding pressure10 stage
		· Decompression device or suitable control to prevent nozzle from drooling
		· Back pressure control
		· Cold start prevention device
	Hydraulic System	
	Servo motor hydraulic system . Access panel and gauge for Oil level and temperature indication should be provided.	
	It should have single or dual pump system and water cooled heat exchanger.	
	Control Unit	
	Operation	· Equipped with micro process computer controller
		· LCD display
		· Storage of 150 to 200 sets of mould data
		· 3 to 5 Stage or equivalent PID barrel temperature control
		· Proportional hydraulic system
		· Multi alarm system
		· Self detection during machine operation
	Other Features	Bimetallic screw barrel
		· Barrel air cooling device
		· Extended nozzle
		· Multi hydraulic core pulling / unscrewing device
		· Hydraulic oil should be provided as per requirement

		· Hydraulic oil temperature control
		· Automatic suck back system
		· Overload protection for pump motor
		· Safety systems should be provided
	Auxiliary Equipment	· Hopper dryer
		· Mould temperature controller
	Pump Drive	please specify
	Minimum Spares	· Heaters with sensors for barrel & Nozzle-2 set
		· Extended nozzle-1 set
		· Hydraulic Oil, Grease, lubricating oil-As per requirements for operation of Machine.
		· Hard copies of Operational &Service Manual- 01 set
	Mandatory Items	While supplying the Machine, the supplier should provide basic Tool Kit box with all necessary Tools& safety gloves & goggles required for day to day activities during operation of Machine. The Machine should come with all other essential accessories & spares required for installation,& commissioning .
	Chiller	Chiller of 5 T capacity to be supplied along with the machine
	Other Mandatory Items	While supplying the Machines, the supplier should also provide the following items apart from above:

		· Machine should come with all other essential accessories (from OEM only) & spares required for installation, commissioning& Operation

18 **KARL FISCHER TITRATOR**

	Measuring method	Coulometric titration method
	Range of Moisture Detection	0 - 300 PPM or better
	Display of Reading	Direct Reading of Moisture in PPM, Percentage(%) & mg/ml of water
	Dispenser	Motorized Dispensing
	Electrode	Dual Platinum Electrode.
	Display	LCD
	Burette capacity	25 ml or better
	Titration vessel	100ml or better
	Reagent bottle	Amber colored
	Other features	A small glass/ teflon tube - closed at one end and fitted at the other with a rubber stopper should be provided for weighing and introducing into the titration vessel

19 **Mechanical Stirrers**

	Max. stirring capacity	5 Liters
	Speed rotation range	50-2000 rpm
	Speed rotation control	Step less speed control
	Chuck range	3 to 16 mm
	Work conditions	Temperature ≥30°C
	Motor	1000W or better
	Blades	Electro-polished stainless steel 316L
	Display	LCD
	Other Features	Wide range of stirring shafts
		High durability to chemicals

		Ability to mix high viscosity liquids
		Overload protection

20 **Planetary Ball Mill**

	Requirement	Suitable for materials: hard, medium-hard, soft, brittle, moist
	Input size:	6-10 mm
	out put product:	100 mesh
	No. of sample holders:	1 or 2 nos on rotating table
	No. of bowls (jar):.	3
	Table Speed:	40-400 rpm
	Time Speed indicator:	digital display
	Timer:	1 - 900 min (Programmable)
	Digital display for	Plate r.p.m., Bowl r.p.m., Total cycles & current cycles number, time
	1. rotational speed (rpm)	variable speed from 1- 500 or higher
	2. On Time :	1- 900 mins
	3. Off time:	1 - 900 mins
	4. No. of cycles:	1-900
	5. Time setting:	Run time and off time
	6. Direction:	Forward, Reverse
	7. Acceleration:	1 - 60 secs
	8. Deceleration:	1 - 60 secs
	9. Door position:	Open or Closed (for safety)
	Safety Features: Door switch for machine, current overload safety for motor protection	
	Motor & Drive: AC Motor with variable speed AC frequency control microprocessor based drive Setting parameters on Display:	
	Essential Accessories:	
	Tungsten coated bowl sets (50 ml, 250 ml and 500ml).	
	Tungsten carbide balls (16 mm): 3set (10 nos each)	
	Tungsten carbide balls (20 mm):3 set (5 nos each)	
	Tungsten carbide balls (12 mm) : 3 sets (10 nos each)	
	Optional Bowl made of Zirconium Oxide, Sintered Aluminium Oxide and stainless steel.	

21 **Plastic Pulveriser**

	Grinding Chamber	Special serrated Liner on the Top and perforated Screen groove at the bottom.
	Feeding	Smooth finished M.S. Gravity Feed Hopper.
	Hopper for pneumatic	At the discharge end of the Pulverizer Hopper is Fabricated out of thick M.S Sheet.
	Connecting Pipe	OD M.S Pipe connecting Hopper and the Blower.
	Rotor Assembly	Rotor shaft with special hardened M.S. Beaters fitted with heavy duty Ball Bearings.
	Cyclone	Cyclone to be fabricated out of M.S Sheet.
	Base	Strong M.S. Structure made of thick M.S. channels for mounting the Pulverizer and Electric Motor.
	Dust Collector	To be Fabricated out of thick M.S Sheet for Air Discharge with cotton bags.
	Accessories	'V' Belt, 'V' Belt Pulleys, Cotton Bag, Balloon and three different types of sieves. Vibro Feeder with Controller.
	Capacity	150 Kgs/hr or better upto 20 to 30 mesh depending upon different types of plastics to be pulverized.
	Feed material	Grinding Rigid & Soft PVC, PE, HDPE, PV, ABS, and Plastic Scrap.

22 **RAMAN SPECTROSCOPY (FT-Raman Spectrometer)**

	Make	Bidder to specyify
	Model	Bidder to specify
	Applications	

Laser (Option)	YAG laser: 1,064 nm; 1, 2, or 3 W (air-cooled)
Rejection Filter	150 cm^{-1} or more (Raman shift value)
	50 cm^{-1} or more (Raman shift value) (Option)
Detectors	InGaAs: ~3,600 cm^{-1}or more (at R.T.)
	~3,000 cm^{-1} or more (77 K) (LN2-cooled)
Interferometer	Beam splitter: Si/CaF_2
Sample Stage	XYZ stage
Beam Collecting System	Lens method: F/0.63
Data Processing Functions	Smoothing, Baseline correction, Peak picking, Sensitivity correction, Arithmetic, Derivatives, Subtract, Raman shift, wavenumber conversion, Data truncate, Overlay, IF conversion, J-CAMP format conversion, Text format conversion
Other Standard Components	Laser plasma line rejection filter, Laser power monitor, Light source for Raman intensity correction (Halogen lamp), Interlock mechanism (Laser safety operation), Raman scattering collecting system (uses gold-coated mirrors)

	Optional Accessories	Liquid sample cell / Liquid sample cell holder/ Powder holder, 90 degree scattering measurement system, TV monitor system for sample observation, Microscopic measurement system (Objective lens: X10, X50 including TV monitor system), Polarization measurement system (1/2 plate, Polarizer), Large XYZ stage, Thermal analysis system, Mapping system, Anti-vibration bench

23	**Refractometer**	
	Measurement range	0 to 32 % Brix
	Accuracy	±0.1 %
	Resolution	0.10%
	Temperature	10 to 40° C.
	Temperature accuracy :	±0.05° C
	Dimensions	200 x 29 mm
	Weight	260 g to 280 g
	Display	LCD Display with touch screen facility.
	Light source	LED Lamp

24	**SOXHLET APPARATUS**	
	Extractor sizes from 50 to 250 ml.	
	Kompakt units for single sample processing.	
	Heating block units with especially exact temperature control for simultaneously processing up to 6 samples.	
	Extraction systems for four or six samples with linear configuration of individual extractors.	
	Extractors with a specially developed siphon tube guarantee uniformity of extraction in all sample positions.	
	Extractors provided with spigots for draining solvent obviate need to distill solvent before reuse.	
	No rotary evaporator is required.	

	Use of the hydrolysis glassware kit (for 1, 4 or 6 sample units) enables acid digestion to be performed prior to extraction in accordance with the Weibull and Stoldt method for determination of total fat content.

25 **THERMAL CONDUCTIVITY TESTER**

	Make:	Bidder to specify
	Model:	Bidder to specify
	Sample Thickness range	0.5 mm to 25 mm
	Sample Dimension	Dia 50mm to 62 mm
	Thermal Conductivity Range	0.1 W/m.K to 10 W/m.K or better
	Thermal Resistance Range	0.005 to 0.05m^2 K/W
	Accuracy	± 4% or better
	Reproducibility	± 2% or better
	Temperature of measurement	0° to 90°C or better
	Temperature resolution	± 0.01°C or better
	No, of temperature Programmes	10 or more
	Compliance to Standards	ASTM C518 & 1SO 8301
	Accessories	Please quote for essential and optional accessories separately

26 **TORQUE RHEOMETER**

	Make	Bidder to specify
	Model	Bidder to specify
	Applications	Machine could capable to study the following properties
		a. Viscosity, flow behaviour
		b. Compounding formulation and recycling of polymer
		c. Blend ratio
		d. Extrusion and injection moulding processability
		e. Morphology
		f. Influence of the screw design on the viscosity
	Temperature Range	ambient to 450ºC
	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

27	Ultrasonicsonicator	
	Power Rating	750 Watts
	Frequency	20 ± 2 KHz
	Programmability	10 memories
	Programmable Timer	99 hours
	Sequencing	Optional
	Adjustable Pulse On/Off	1 second to 10 seconds

	Dimensions	@ 15'W × 12'L × 6.5'H
	Voltage	230V, 50 Hz

28 **Vacuum Casting**

	Make	Bidder to specify
	Model	Bidder to specify
	Max. Mould Size	750 x 600 x 550 mm or better
	Casting Capacity	2 ltr , 5 ltr (twin robot) or better
	Pump Capacity	>60 m³ / hr or better
	Max Vacuum	>0.45 mbar or better
	Features	· PLC Control with touch screen and Automation
		· Differential pressure system for high viscosity resin casting
	Materials	Nylon, filled nylon, PU based resins, wax etc.
	Material Quantity	Vendor should quote all possible materials and supply minimum quantity required for 3 months on each material, excluding the quantity of material required for installation, training and calibration. Machine should be calibrated to fabricate parts with all the materials mentioned above at the time of installation.
	Material blender	Suitable blender to mix silicon resin should be supplied
	Air Circulation Oven	Suitable ovens for material storage, Mould and Product Curing, Bidder to specify and quote
	Dust and Fume bench	Bidder to specify and quote

	Any other accessories/Options if available for better utilization	Vendor should supply the accessories such as pigments, magic ink, scalp blade, scalp blade handle, insert funnel, yellow tapes, black tape, whisker, mixing cup, releasing agent, master releasing agent, adhesive, paints, filler , hose joints (small, medium, large) etc.
	Scope of supply	Attach list for scope of supply
	Installation requirements	State space required and condition of floor and any other requirement for installation of the machine and equipment.
	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.
	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.
	Manufacturer’s credential	Should have sizable installations of same model worldwide and at least two same or similar model in India.
	Warranty and guarantee	The machine shall be guaranteed for at least Three years for replacement and service against any design, manufacturing and workmanship defects.

29 Vacuum Pump

	Type	**Two stage diaphragm**
	Vacuum range	7 mbar or more
	Material	Chemical resistance
	Electrical requirement	According to Indian standard
	Vacuum control	Manual
	Suction capacity	1.0 m^3 /h or better
	Maximum Noise level	Less than 50 dB at 1 meter distance
	Other features	Oil free operation for reduced maintenance
		Inlet liquid trap
		Adjustable Vacuum / Pressure

30 Vibration Lab

	Make	Bidders to specify
	Model	Bidders to specify
	Modal shaker with power amplifier.	
	Max. Force Sine/Random(N)	50/35N
	Max. Displacement(mm)	±7.5mm
	Frequency Range(Hz)	DC-5k
	Excitation output	10-32 mounted stingers
	Max. Input current(Arms)	≤6
	Armature Coil resistance (Ω)	1.5
	Effective mass (Kg)	0.25
	Size(mm)	Φ138 × 160
	Mounting Hole(mm)	158×128/4-Φ8,
	Power Amplifier	100W/200W
	Cooling	Natural Air cooled option.
	Dynamic Signal Analyzer,	
	(i) Hardware specification	
	Portable all-in-one data acquisition system, rugged industrial design	
	4 slots for user exchangeable modules	
	13" TFT wide-screen display 1280 x 800 pixels	
	Intel® Core™ i7 processor, 4 GB RAM	
	120 GB removable flash disk, max. data throughput 90 MB/s	
	4x USB, 1x LAN Ethernet, WLAN interface with external antenna, 1x RS-232	
	1x external VGA socket, AUDIO interface,	

Lemo EGG.1B.304 socket for EPAD	
Isolated power supply 11 to 32 VDC, incl. external AC adaptor	
Power supply cable to cigarette lighter, 2 m	
Microsoft® Windows® 7 operating system	
8 channel universal analog input module	
24-bit resolution, simultaneous sampling, 204.8 kS/s per channel, anti-aliasing filters	
Bandwidth DC to 77 kHz	
Measure modes: bridge, voltage, IEPE, resistance, temperature and current	
Programmable excitation voltage from 0 - 13 VDC, independent for each channel	
Programmable excitation current from 200 µA - 25 mA, independent for each channel	
DC or AC coupling, 4 high pass filters 0.16, 0.5, 3.4 and 10 Hz	
Bridge input: full bridge sensors 80 Ohm to 10 kOhm (@ excitation <=5 V)	
Internal completion for 1/2 bridge sensors 80 Ohm to 10 kOhm	
Internal completion for 1/4 bridge sensors 120 and 350 Ohm	
Freely programmable ranges from ±1 to ±1000 mV/V or mV/mA	
Automatic bridge offset adjustment up to approx. ±250 % of range	
2 internal shunts for shunt calibration	
Voltage input: freely programmable ranges between ±10 mV to ±10 V	
Differential or single-ended inputs	
IEPE input: freely programmable ranges between 100 mV to 10 V, fixed constant current source 4 mA	
Resistance input: freely programmable ranges between 10 Ohm to 30 kOhm	
Temperature input: Pt100, Pt200, Pt500, Pt1000 or Pt2000 sensors	
Current input: via external shunt (not included)	
Complete self-check functionality and TEDS support	
Connectors: mating connectors included	
Detailed calibration report included	
(ii). Software specification	
Complete turn-key data acquisition software package, easy to use, includes recorder, scope, trigger capabilities, FFT analysis, data storage and export, data analysis and report functions,	

Video support and hardware synchronized Video support for multiple cameras,	
Measurements for Industrial Acoustic, Structural Analysis and Machinery Diagnosis.	
Industrial Acoustic: Real time narrow band FFT, Real time 1/1, 1/3, 1/12, 1/24 band octave spectrum, Real time A-, B-, C-, D-weighting, Fast-Slow- Impulse-weighting, Leq-Calculation, and Sound Level according IEC 60651, 60804, 61672.	
Structural Analysis: Measurement of transfer functions (FRF) for SISO, SIMO and MIMO configurations with H1, H2 and Hv algorithm. Excitation can be either an impulse (modal hammer) or continuous.	
In this case internal function generator (OPT-FGEN) or external generator source might be used. Structure geometry can be created or imported from UNV, online measurements of FRF, coherence, phase and amplitude is possible. Machinery Diagnostics: Order Analysis, rotational and torsional vibration, waterfall diagram. Human Body Vibration according to ISO 8041, ISO 2631-1.	
Modal Analysis Software (3D visual),	
Basic geometry modeling ,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 .	
Tri-axial Accelerometer with connecting cable,	
Built-in IEPE preamplifier Tri-axial (x,y,z) miniature accelerometer Single 4-pin Connector.	
Measuring Range: ±500g,	
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 : ≤ 5 %,	
Non-linearity :< 1%,	
Weight : 9 g,	
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 , ±peak : 1000g,	
Temperature range, operating : -40 to +250 ˚F,	
Transient temperature : 0.01 g/˚C,	
Base strain sensitivity : 0.0002 g/µe,	
Accessories	
Calibration certificate,	
10-32 mounting stud,	
Single 4 pin connector with 5meter length and 3 BNC male connector end.	
Impact hammer with connecting cable	
Hammering modal measuring structure ,	
Suitable for modal analysis measurement ,	
Customized IEPE circuit,	
Different type buffer heads (Hammer caps),	
*Nylon, *Rubber, *Aluminium, *Stainless steel, *mass	
Sensitivity : 4 pC/N,	
Max. Shock force: 60KN,	
Head Diameter: Φ30,	
Head weight : 150Gram,	
Length of handle: 300,	
Fixture with test specimen.	
Mechanical fixture for modal ,free and forced vibration setups ,	
Cantilever test specimen for study of free and forced vibration.	
Any other accessories if available for better utilization	Bidder to specify and quote
Scope of supply	Attach list for scope of supply
Installation requirements	Bidder to specify , pre-installation requirement
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.

	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.
	Manufacturer’s credential	Should have sizable installations of same model worldwide and at least two same or similar model in India.
	Warranty and guarantee	The machine shall be guaranteed for at least Three years for replacement and service against any design, manufacturing and workmanship defects.