

HITEC UNIVERSITY TAXILA
Department of Mechanical Engineering

Ref: ME/MA/1015/102

January 04, 2019

To: The Manager Administration
HITEC University
Taxila

Subject: GSRs/RFP of MED Lab Equipment 2018-2019

1. The following Lab equipment of MED against which Budget allocation has been made are submitted for further action please. The same may form part of the respective contract to facilitate subsequent inspection. In some cases a Request For Proposal (RFP) has been floated in which samples and material specifications must be provided by the Suppliers.
2. Item at serial number 4 is also a RFP, and suppliers should visit MED to ascertain exact requirement, before proposing a solution.

s.n	Lab	Nomenclature	Annex
1	IC Engine Lab	Vehicle Emission Gas Analyzer NHA506	Anx A
2	Thermo Lab	Four-channel USB Voltage and Thermocouple DAQ	Anx B
3	CNC Lab	CNC Router USB MACH3 (4-Axis CNC Router 8060z) stroke 65mm	Anx C
4	CNC Lab	6 Refurbished Computers, Core2Duo E8500 Processor, Intel G41 Motherboard, 4GB DDR3, RAM and 250GB, SATA 3.0Gbps HDD, dedicated Graphics card with at-least 512MB of 128-Bit GDDR5 memory and DirectX 10 compatible.	Anx D
5	Mech of Mat Lab	K-Shear accelerometer (50-500g)	Anx E
6	Mech of Mat Lab	Data Acquisition System for Accelerometer	Anx F
7	Mech of Mat Lab	Extensometer Instrument	Anx G
8	Mech of Mat Lab	Vacuum Based Laboratory Oven for Composites Curing, 100 l capacity	Anx H
9	Mech of Mat Lab	Magnetic Stirrer + hot plate	Anx I
10	Mech of Mat Lab	Fibers and Fabrics (Glass/ Carbon/Natural etc.)	Anx J
11.	Mech of Mat Lab	Thermoplastic resins (Polypropylene, Polyethylene, Polyester etc.)	Anx K
12.	Mech of Mat Lab	Vacuum Bagging Kit (Vacuum Bags, Peeling cloth, breathing cloth, Sealing tap, releasing agent and Gloves)	Anx L

3. Forwarded for action please.

(Dr.S.Kamran Afaq)
Chairman Mechanical Engineering Department

GSR of Exhaust Emission Gas Analyzer (5-Gas)

For ICE Lab MED

1. **General Statement of Requirement (GSR).** An Exhaust Emission Gas Analyzer for measuring concentration of HC, CO, CO₂ O₂ and NO_x, contained in exhaust gases from gasoline engines is required. Advanced NDIR (Non-Dispersive infrared) analysis technology is to be used to measure HC, CO, CO₂ and the newest generation of electrochemical technology adapted to measure O₂ and NO in exhaust emissions.

2. **Picture for guidance.** A Pictorial view of an Exhaust Gas Analyzer is shown below.



3. **Working System and Technical Specifications.** The Exhaust Gas Analyzer should be robust and should be able to measure HC, CO, CO₂ O₂ and NO_x and provide immediate read out of the same. The output should be compatible with Windows system used in our labs.. Other parameters are as follows:-

- | | | |
|----|--------------|--|
| a. | Voltage: | Nominal 220V AC (195-245 volts) |
| b. | Item HxWxL: | 200x300x480 mm (Not to be exceeded) |
| c. | Item Weight: | Total 19kg -20 kg (Not to be exceeded) |
| d. | Software: | Software in English to be integral to the purchase |

4. **Main Features**

- Large LCD screen for easier setting and operation as shown in picture.
- Automatic calculation and display of A/F (air-fuel)-ratio and Lambda air ratio.
- Should be able to measure Emissions from vehicle engine fuels including CNG, LPG, ethanol mixed and pure gasoline.
- Inductive clip-on pickup sensor for RPM measurement to be included.
- Oil temperature measurement probe to be included.
- RS-232C digital serial interface and cables to be included.
- Provision for storage and review of 200 groups of measurement data.

5. Main Technical Specifications

a. Measure Range:

HC:	0~9,999	$*10^{-6}$ (n-Hexane)
CO:	0~10	$*10^{-2}$ (%)
CO ₂ :	0~18	$*10^{-2}$ (%)
O ₂ :	0~25	$*10^{-2}$ (%)
NO:	0~5,000	$*10^{-6}$ (%)

b. Measurement Accuracy:

HC:	± 12	$*10^{-6}$ (abs.)	0 ~ 2,000 $*10^{-6}$
	± 5	$*10^{-2}$ (%) (rel.)	0 ~ 2,000 $*10^{-6}$ (whichever is larger)
	± 10	$*10^{-2}$ (%) (rel.)	2000 ~ 9999 $*10^{-6}$ (whichever is larger)
CO:	± 0.06	$*10^{-6}$ (%) (abs.)	
	± 5	$*10^{-2}$ (%) (rel.)	(whichever is larger)
CO ₂ :	± 0.1	$*10^{-2}$ (%) (abs.)	
	± 5	$*10^{-2}$ (%) (rel.)	(whichever is larger)
O ₂ :	± 0.1	$*10^{-2}$ (%) (abs.)	
	± 5	$*10^{-2}$ (%) (rel.)	(whichever is larger)
NO:	± 25	$*10^{-6}$ (%) (abs.)	
	± 4	$*10^{-2}$ (%) (rel.)	(whichever is larger)

c. **Response Time :** Less than 10s (O₂, less than 12s. NO, less than 15s)

d. **Warm-up Time:** 10min. (ambient temperature is not lower than 20°C)

6. **Operator, Maintenance and Technical Manuals/Illustrated Parts Catalogue.** All documentation/publications mentioned must be supplied both in hard and soft form. They must be supplied along with the product so that completeness/accuracy of the product may be ascertained at time of delivery, and performance can be checked. Need for calibration and how to carry it out to be mentioned as well.

7. **Training.** At least one faculty member and one Lab assistant to be trained, not only on use of the equipment but also simple troubleshooting, calibration and replacement of parts.

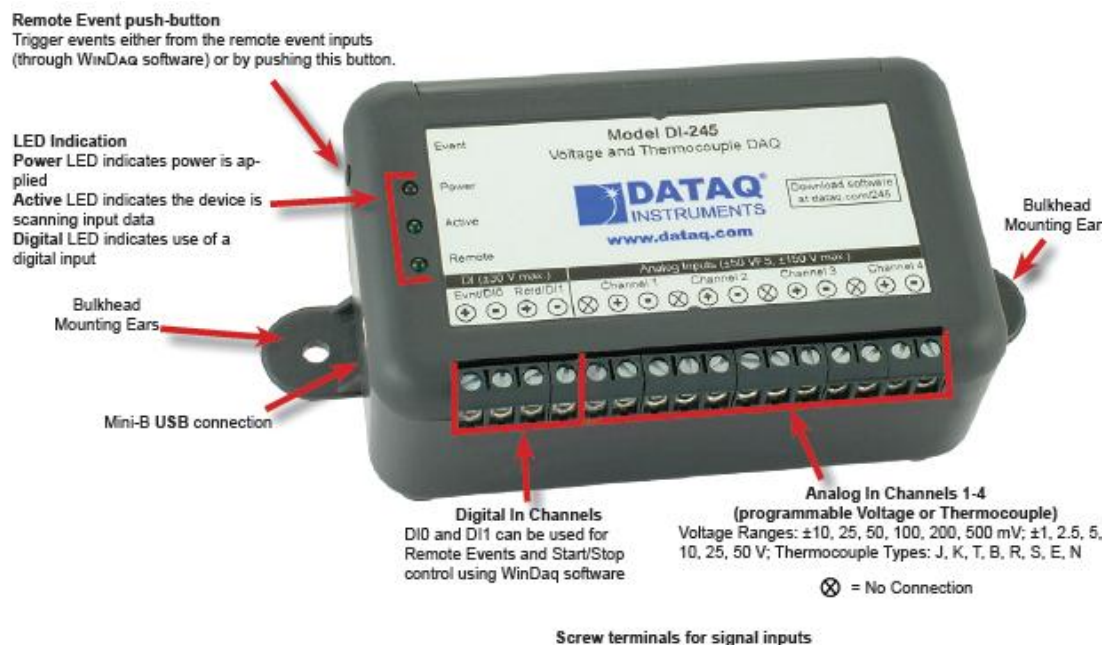
8. **Spare Parts and Consumables.** A list of spares required on a frequent basis (fast running spares) and those needed for calibration need to be included along with assurance of continued and quick supply.

GSR of Four-channel USB Voltage and Thermocouple Data Acquisition System Model : DI-245

For Thermo Lab MED

1. **General Statement of Requirement (GSR).** A four-channel USB Voltage and Thermocouple Data Acquisition system along with appropriate software, is required for acquiring and recording data input both Analogue as well as Digital, from thermocouples and transferring it to computer/laptop through USB ports, and facilitation of studying the waveforms on computer screen. It should be robust and easily calibrated when required. Complete calibration procedure should be easily conducted and all items required should be available in Pakistan.

2. **Picture for guidance.** A pictorial view of a four-channel USB voltage and thermocouple DAQ is shown below.



3. **Working System and Technical Specifications.** The DAQ should be able to work with analog as well as digital Inputs. Details are as follows:

- a. **Analog Inputs.** The DAQ should feature four differential channel inputs located on the sixteen-position screw terminal blocks for easy connection and operation (other terminals used for digital inputs). Each channel be programmable to acquire data as Voltage (ranges: $\pm 10, 25, 50, 100, 250, 500$ mV; $\pm 1, 2.5, 5, 10, 25, 50$ V) or

Thermocouple temperature (types J, K, T, B, R, S, E, and N are supported). All supporting software should be included.

- b. **Digital Inputs.** The DAQ should feature at least two digital lines (bits) for WINDAQ remote control operations (Evtnt/DI0 and Rcrd/DI1). Connect switch closures or discrete levels with a maximum input of 30V and a threshold of 1.8V.
 - c. **Software Required.** The software required to record and playback waveforms should be considered a part and parcel of the DAQ and should be included with it.
4. **Technical Requirements.** The DAQ should have Programmable Voltage Ranges per Channel and should be able to support multiple thermocouple types with easy calibration. Calibration chart for every thermocouple or voltage source must be provided along with the equipment.
 5. **Data Recording.** Primary concern for buying this equipment is data recording so the supplier must make sure that DAQ must support data recording for infinite use of every type of thermocouple or voltage.
 6. **Data Export.** Data acquired by DAQ should be stored in the WINDAQ and exported to latest versions of MS OFFICE or any other writing tool.
 7. **Plug and Play.** The equipment supplied should support easy plug and play with latest version of Microsoft Windows and processing systems.
 8. **USB type connectivity.** All types of USB data and power cables (2.0 or 3.0) required to use the DAQ must be included.
 9. **Operator, Maintenance and Technical Manuals/Illustrated Parts Catalogue.** All documentation/publications mentioned must be supplied both in hard and soft forms. They must be supplied along with the product so that completeness/accuracy of the product may be ascertained at the time of delivery, and the performance can be checked. The need for calibration and its procedure should be mentioned as well.
 10. **Training.** At least one faculty member and one Lab assistant is to be trained, not only regarding the use of the equipment but also to replace parts and to perform simple troubleshooting, calibration and replacement of parts.
 11. **Spare Parts and Consumables.** A list of spares required on a frequent basis (fast running spares) and those needed for calibration should be included along with assurance of continued and quick supply.

GSR of CNC Router USB MACH3 (4-Axis CNC Router 8060z) stroke 65mm

For CNC Lab MED

1. **General Statement of Requirement (GSR).** 4-Axis Router/Engraver for specialized engraving/routing operations using different sets of specialized tools which are conventionally not used in Milling. The respective CAM Lab course will be updated accordingly for engraving, routing, use of routing/engraving tools and CNC programming pertaining to the same.
2. **Picture for guidance.** A Pictorial view of CNC Router is shown below for guidance.



3. **Working System and Technical Specifications.** The Exhaust Gas Analyzer should be robust and should be able to measure HC, CO, CO₂ O₂ and NO_x and provide immediate read out of the same. The output should be compatible with Windows system used in our labs.. Other parameters are as follows:-

- a. Voltage: Nominal 220V ~ 240V 50 Hz AC
- b. Item HxWxL: 1120x880x520mm (As specified in official specs)

- c. Item Weight: ~ 90Kg (incl. packaging as officially specified)
- d. Software: MACH 3 CNC Software with G-code integration (in English language)

4. Main Features

- a. Equipment for professional Routing/Engraving operations
- b. Specifications are upto the mark for industry standard routing/engraving
- c. Suitable for a wide variety of operations including milling, drilling, contouring and routing
- d. Live monitoring of the machining operations via supervisory interface provided by MACH 3
- e. Should support compatible G-code files in versatile formats

5. Main Technical Specifications

- a. **Workspace:** XYZ = 585x790x65mm
- b. **Positioning Accuracy:** 0.05mm in all axes
- c. **Acceptable Material Thickness:** less or equal to 90mm
- d. **Frame Material:** 6061-T5 Extruded Aluminum Alloy
- e. **Rail Type:** Chromeplate shaft+Linear Bearings
- f. **Screw Type:** Ball screw, Diameter 16mm, screw thread pitch 5mm
- g. **Mechanical Resolution:** 0.0025mm/step in all axes
- h. **Spindle Motor:** 2200W Brushless with 3000~24000rpm
- i. **Collet Type:** ER16 (equipped with 3.175 and 6mm collet)
- j. **XYZ Motors:** 60BYGH-4.2A Stepper Motor
- k. **Feed Rate:** 300~4000mm/min
- l. **Communication Interface:** USB 2.0 via MACH 3 software on a Desktop PC running Windows XP/Windows 7/Windows 10
- m. **Command code** Gcode /.nc/.ncc/.tab/.txt
- n. **Package Dimensions** 2 Boxes (1080x180x800mm + 820x370x400mm as advertised officially by manufacturer)

6. **Required Documentation:** Operation manual, Assembly/Disassembly Manual, MACH 3 Software Manual, periodic maintenance manual all in hard as well as soft-copies. Clearly illustrated and updated according to the equipment and PC OS.

7. **Training.** At least one faculty member and one Lab assistant to be trained, not only on use of the equipment but also simple troubleshooting, calibration and replacement of parts.

8. **Spare Parts and Consumables.** A library of Routing, Engraving tools is to be provided compatible with the equipment. A list of spares required on a frequent basis (fast running spares) and those needed for calibration need to be included along with assurance of continued and quick supply.

RFP of Refurbished Six Computers, Core2Duo, Intel G41 MB, and Dedicated Graphics card,

For CNC Lab, MED

1. General Statement of Requirement (GSR). 6 existing desktop computers are required to be upgraded/replaced by refurbished computers to enable quicker processing of CNC software as well as CAD to CAM design and interpolation software such as MasterCAM X5, AutoCAD 2017, ArtCAM 2013. It is essential that the final product provide satisfactory performance with dedicated graphics for the aforementioned software as well as SolidWorks and Creo. The display monitors are to be upgraded as well which are to be included with every PC. It is expected that this requirement be treated as a Request for Proposal (RFP), and suppliers must visit MED to ascertain exact requirement, before proposing a solution.

2. Picture for guidance. Picture is just for the sake of reference and not exactly according to the physical requirement.



3. Working System and Technical Specifications. The PC should be in Tower form-factor to support a full-profile Dedicated graphics card, Monitor should be LCD display with at-least 19inch of diagonal display dimension.

- a. **Processor:** Intel Core2Duo E8500 or E8300 Processor.
- b. **Mainboard:** Intel G41 chipset with PCI-Express and DDR3 Ram support
- c. **RAM memory:** 4GB of DDR3 RAM

- d. **Graphics Card:** at-least 512MB of dedicated Graphics memory with at-least 128-bit of GDDR5 memory bus and DirectX 10 compatible.
 - e. **Power Supply:** at-least 400W Power Supply with sufficient power for PCI-E graphics
 - f. **Storage:** 250GB of SATA 3.0gbps (SATA II) Hard disk drive
 - g. **Monitor:** 19 inch diagonal, LCD Display with every desktop PC
4. Special Case: This is a case of special requirement, thus suppliers are advised to provide the technical **specifications**/detail of their own stock in-case there is no exact match for the above requirements.
5. Warranty: A warranty/guarantee of at-least two years would be required.

GSR of K-Shear Accelerometer (50-500g)

For MOM/Vibration Lab MED

1. **General Statement of Requirement (GSR):** An accelerometer is a device that measures acceleration. It behaves as a damped mass on a spring. When the accelerometer experiences an acceleration, the mass is displaced to the point that the spring is able to accelerate the mass at the same rate as the casing. The displacement is then measured to give the acceleration. The accelerometers have been widely used to measure vibration in different structures.
2. **Picture for Guidance:** The picture below shows how the accelerometer looks like.



Fig. 1: Picture of miniature accelerometer

3. **Approx. weight and dimensions:** The following should be the weight and dimensions of the accelerometer.
 - a. **Weight:** Less than 5 grams
 - b. **Dimensions:** Length, width and height should not be greater than 20 mm each.
4. **Main technical specifications:** The following should be the technical specifications of triaxial miniature accelerometer.

Sr No.	Characteristics	Limits
1.	Acceleration Measuring Range	$\geq \pm 50 \text{ g}$ and $\leq \pm 500 \text{ g}$ ($1\text{g}=9.8066 \text{ m/s}^2$)
2.	Resonant Frequency	$> 50 \text{ KHz}$
3.	Frequency measuring range	$> 5 \text{ KHz}$
4.	Measurement directions	All three directions (X,Y,Z)

5. **Technical Manuals:** All documentation must be supplied, both in hard copy (original print, NOT photocopy) along with good quality soft copy in hard case covers. They must be supplied along with the product so that accuracy of the documents can be verified.

GSR of Data Acquisition System for Accelerometer

For MOM/Vibration Lab MED

1. **General Statement of Requirement (GSR):** Data acquisition is the process of sampling signals that measure real world physical conditions and converting the resulting samples into digital numeric values that can be manipulated by a computer. Data acquisition systems, abbreviated by the acronyms DAS or DAQ, typically convert analog waveforms into digital values for processing.
2. **Drawing for Guidance:** The pictures below shows how the typical Data Acquisition System looks like.



Fig. 2: Picture of typical DAQ system

3. **Working system and technical specifications:** The Data Acquisition system (DAQ) should interface with the Triaxial miniature Accelerometer 500g (Given in Anx A) and able to acquire and process the data from the accelerometer. All accessories including cables should be provided along with the Data Acquisition system (DAQ) for the proper working of the system. The sampling frequency of the system should be greater than 5 kHz.
4. **Approx. weight and dimensions:** The following should be the weight and dimensions of the accelerometer.
 - a. Weight: Should be less than 1 kilograms.
 - b. Dimensions: Should not exceed 20 cm in all directions.
5. **Technical Manuals and Software:** All documentation mentioned must be supplied, both in hard copy (original print, NOT photocopy) along with good quality soft copy in hard case covers. Also, the **software** should be provided along with the Data Acquisition System (DAQ) which should work on Windows based platform (PC, Laptop).

GSR Extensometer Instrument

For MOM Lab MED

1. **General Statement of Requirement (GSR):** An Extensometer to measure deflection on the specimen under different loads, required for post graduate research and teaching undergraduate mechanical engineering students. The extensometer must be compatible with WDW-100E Universal Testing Machine

2. **Diagrams for guidance:**



Extensometer along with cable and RS-232 DB9 Connector (close up shown) is required

3. **Experiments:**

- a. The Axial deformation extensometer, should be able to test metal as well as non-metallic materials.
- b. It would include regular extensometer, average strain extensometer, special extensometer (large standard steel hinge line, concrete, rocks, wood, etc.).
- c. It should be able to measure elastic modulus E, provisions non-proportional extension intensity RP, stipulated total extension strength RT, various elongations, strain hardening exponent N and other parameters.

4. **Technical Parameters:**

- a. The strain gauge resistance: 350 ohms.
- b. Bridge voltage value: acuities 6V (dc, ac all can)
- c. Output sensitivity: about 2mV/V.
- d. Extensometer gauge length: 25 mm.

- e. Maximum deformation: 4 mm.
- f. Output terminal connector: four core or five core plugs, etc

5. Key Features:

- a. May be left on through specimen failure.
- b. Measure in both tension and compression and can be used for cyclic testing.
- c. The kit should allow one hand mounting to specimens. Mechanical over-travel stops in both directions.
- d. It should meet ASTM class B-1 requirements for accuracy.
- e. Should be rugged and with dual flexure design for strength and improved performance.
- f. Replaceable arms and spacers for ease of repair. Which allows changing the gauge length for different test requirements.
- g. Should operate accurately between 0 and 50 °C.
- h. Should include a high quality foam lined case.

6. Experiment, Operator, Maintenance and Technical Manuals/Illustrated Parts Catalogue: All documentation/publications mentioned must be supplied both in hard and soft form. They must be supplied along with the product so that completeness/accuracy of the product may be ascertained at time of delivery, and performance can be checked. The apparatus should be ready to use all the accessories, documents (hard and soft copies) and software should be supplied with the equipment at the time of purchase.

7. Training: At least one faculty member and one Lab assistant to be trained, not only on use of the equipment but also simple troubleshooting and replacement of parts.

8. Spare Parts and Consumables: A list of spares required on a frequent basis (fast running spares) needs to be included along with assurance of continued and quick supply for 5 years.

GSR for Vacuum Based Laboratory Oven 100 litre capacity

1. **General Statement of Requirement (GSR):** The magnetic stirrer and hot plate equipment is used to mix liquids and particles at different temperatures and RPM.

2. **Diagram for guidance:**



3. **Specifications.** The vacuum based lab oven must contain the following features:

- a. Overtemperature sensor
- b. Double-pane safety glass doors
- c. Stainless-steel vacuum fittings and tubing
- d. Vacuum connection with precision valve and overpressure safety valve
- e. Temperature range: Room temperature to $300\text{ }^{\circ}\text{C} \pm 10\text{ }^{\circ}\text{C}$
- f. Transient temperature control option
- g. Automatic control, Electric Operated, 220 to 240 volts 50 Hz
- h. LED display for control parameters
- i. Capacity: 100 L
- j. Must have at least 3 shelves (removable) inside.
- k. Auto shutoff time : 10,000 minutes

4. **Note:** The equipment should be ready to use, all the accessories must be included. The manufacturer must give a minimum of two years of warranty and maintenance/calibration services for 5 years.

GSR for Magnetic Stirrer + hot plate

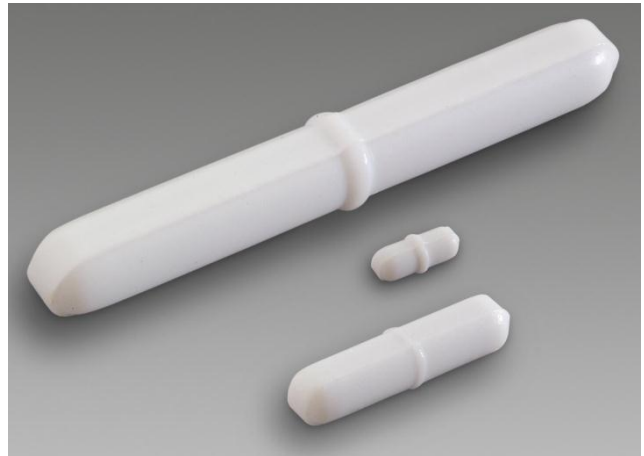
For MOM Lab MED

1. **General Statement of Requirement (GSR):** The magnetic stirrer and hot plate equipment is required to mix liquids and particles at different temperatures and RPM.

2. **Diagrams for guidance:**



Hot plate



Magnetic stirring beads

3. **Specifications.** Magnetic stirrer with heating and ceramic heating plate which offers excellent chemical resistance.

- a. Powerful motor for stirring quantities of up to 5 L
- b. Safety circuit of 500 °C
- c. Hot Top indicator >> hot surface warning to prevent burns!
- d. Exact temperature setting via digital display (LED)
- e. 5 magnetic beads (sizes = 1 in, 2 in, 3 in)
- f. Hot plate Temp range upto 300 °C
- g. Speed control range 0 – 1000 RPM
- h. Max. continuous operation time: 48 hr
- i. Maximum stirring liquid viscosity: upto 15000 cP

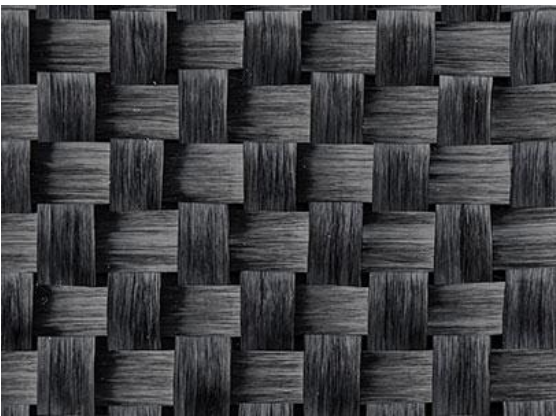
4. **Note:** The equipment should be ready to use, all the accessories must be included. The manufacturer must give a minimum of two years of warranty and maintenance/calibration services for 5 years.

RFP for Fibers and Fabrics (Glass/ Carbon/Natural etc.)

For MOM Lab MED

1. **General Statement of Requirement (GSR):** Various kinds of fibers and fabrics are required which can be used as reinforcement in polymer based composites. Since there is a wide variety available, Suppliers are requested to propose the Fibers and Fabrics that can be provided along with samples and complete Specifications/Datasheets

2. **Diagrams for guidance:**



Bi-directional Fabric



Unidirectional fiber-mat

3. **Material:** In case of unavailability of any of the below mentioned natural fibers, the suppliers may suggest other natural fibers and provide samples. The suggested material may be recommended if it is found useful:

- a. Glass
- b. Carbon
- c. Natural Fibers (Flax & Abaca)

4. **Types of Fibers Required:**

- a. Bi-directional woven fabric: (1m x 50m)
- b. Unidirectional Fiber-mat (1m x 50m)

5. **Note:** The supplier must supply the physical and mechanical properties of the material.

RFP for Thermoplastic resins (Polypropylene, Polyethylene, Polyester etc.)

For MOM Lab MED

1. **General Statement of Requirement (GSR):** These Thermoplastic polymers are required for composites fabrication. All the polymers must be in granular form. Since there is a wide variety available, Suppliers are requested to propose the polymers that can be provided along with samples and with complete Specifications/Datasheets for each.

2. **Diagrams for guidance:**



3. **Material.** In case of unavailability of any of the materials mentioned below, the suppliers may suggest another thermoplastic polymer. The suggested material may be recommended if it is found useful.

- a. Polypropylene
- b. Polyethylene
- c. Polyester
- d. Polylactic Acid

4. **Quantity:**

- a. 5 kg of each resin is required.
- b. Each resin must be in granular form of size < 5 mm

5. **Note:** The supplier must supply the physical and mechanical properties of the material.

GSR for Vacuum Bagging Kit (Vacuum Bags, Peeling cloth, breathing cloth, Sealing tap, releasing agent and Gloves)

For MOM Lab MED

- 1. General Statement of Requirement (GSR):** The vacuum bagging kit is used extensively in the manufacture of complex composite parts using vacuum assisted resin transfer molding process.
- 2. Diagrams for guidance:**



3. Specifications:

The kit must include the following items:

- a. Vacuum Bag: 1m x 50m
- b. Peeling Cloth: 1m x 50m
- c. Sealing Tape (for vacuum trapping): 500m
- d. 6 mm Vacuum Hose (500 m)
- e. Releasing Agent: 500 ml
- f. Rubber Gloves: 500