School of Studies in Chemistry

List of Advanced Instruments

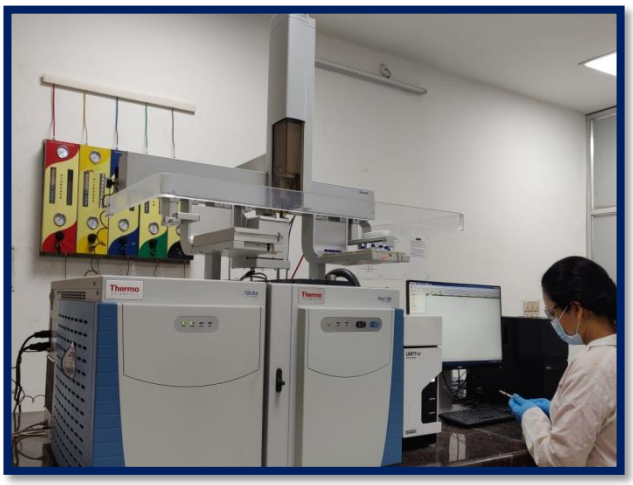
1	**Major Research Fields undertaken**	**1. Atmospheric and Environmental Chemistry, Bio-chemistry and Medicinal Chemistry**
		2. Physical, Organic, Inorganic and Analytical Chemistry
		3. Chemistry of Nanomaterials and Nanotechnology
2	**Major Research Equipments available, (Cost INR)**	1. **TD-GC-MS/MS-ECD-FID**, Thermo Fisher Scientific, Trace 1300 TSQ.000 TD (Marks International) UPS-10KVA MS-TSQDUO, EMERSON TM (Rs: 120.00 Lakh)
		2. **Ion Chromatography**, Dionex ICP-1100 ion chromatography UPS-ABP-P835, 1KVA (Rs: 34.35 Lakh)
		3. GF-AAS, CV-AAS, F-AAS, Thermo Fisher Scientific iCA 3500 Series (Rs: 35.00 Lakh)
		4. **DRS/ATR-FTIR,** Nicolet iS10, Thermo Fisher Scientific Instrument, Madison, USA UPS-3 KVA (Rs: 42.00 Lakh)
		5. **UV-Vis. spectrophotometer**, Thermo Scientific Evolution EV0300PC, UV-Vis model: EVOR (Rs: 10.00 Lakh)
		6. **HPLC**, Thermo Fisher Scientific (Rs. 17 Lakhs)
		7. **Zeta Sizer**, AmilLtd New Delhi (Rs: 27.00 Lakh)
		8. **C, H, S, N/O analyzer**, Thermo Fisher Scientific Mumbai (Rs: 26.13 Lakh)
		9. **Surface tensiometer**, Kyowa Interface Science Co. Ltd (5 Lakhs)
		10. **Fluorescence spectrophotometer**, Agilent Technologies (15 Lakhs)
		11. **Refrigerated centrifuge**, Thermo Fisher Scientific (6.56 Lakhs)
		12. **Water purification system**, Thermo Fisher Scientific (4.67 Lakhs)
		13. **UV-Vis. spectrophotometer with integrated sphere**, Thermo Scientific Evolution EV0300PC, UV-Vis model: EVOR (Rs: 10.00 Lakh)
		14. **Fluorescence microscope**, Weswox Model: FM-5000 (15.70 Lakhs)
3	**Photograph of**	**1. DRS/ATR-FTIR**

	equipments with brief information about its working	 FTIR is a rapid, non-destructive, time saving method that can detect a range of functional groups and is sensitive to changes in molecular structure. FTIR provide information on the basis of chemical composition and physical state of the whole sample. Keeping in mind the fact that FTIR could serve as an effective and powerful tool for quantitative as well as qualitative analysis of organic and inorganic compounds (environmental toxicants and pollutants, persistent organic pollutants and volatile organic compounds) in different compositions and origins of real (solid, liquid and gaseous) samples.
		2. Ion Chromatography  Ion chromatography is used for water chemistry analysis. Ion chromatographs are able to measure concentrations of major anions, such as fluoride, chloride, nitrate, nitrite, and sulfate, as well as major cations such as lithium, sodium, ammonium, potassium, calcium, and magnesium in the parts-per-billion (ppb) range. Concentrations of organic acids can also be measured through ion chromatography. Ion chromatography, a form of liquid chromatography, measures concentrations of ionic species by separating them based on their interaction with a resin. Some typical applications of ion chromatography include: drinking water

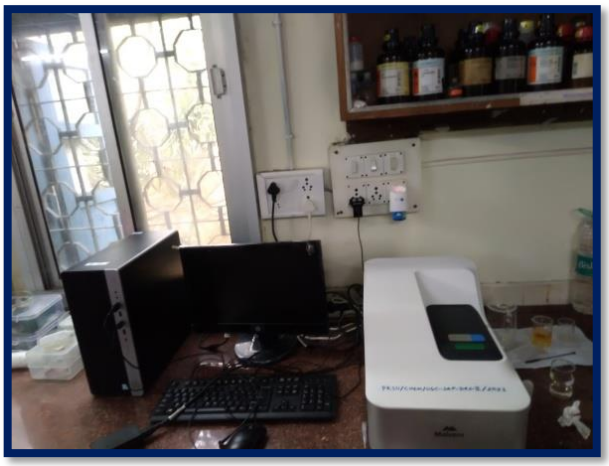
		analysis for pollution and other constituents, determination of water chemistries in aquatic ecosystems, determination of sugar and salt content in foods, isolation of select proteins, ion chromatography has nowadays made its place in several fields, including pharmaceuticals, foods & beverages, clinical studies, water analysis, etc.
		3. CV-AAS, GF-AAS, F-AAS  Atomic absorption spectroscopy (AAS) is a spectroanalytical procedure for the quantitative determination of chemical elements using the absorption of optical radiation (light) by free atoms in the gaseous state. AAS is based on absorption of light by free metallic ions. In analytical chemistry the technique is used for determining the concentration of a particular element (the analyte) in a sample to be analyzed. AAS can be used to determine over 70 different elements in solution, or directly in solid samples via electrothermal vaporization, and is used in pharmacology, biophysics, archaeology and toxicology research. Atomic absorption spectrometry has many uses in different areas of chemistry such as clinical analysis of metals in biological fluids and tissues such as whole blood, plasma, urine, saliva, brain tissue, liver, hair, muscle tissue. Atomic absorption spectrometry can be used in qualitative and quantitative analysis.
		4. UV-Vis. spectrophotometer

V-Vis spectrophotometric technique is used for characterization and quantification of complex mixture or synthesized materials on the basis of LSPR band through the color change. It is one of the best methods for determination of impurities in organic molecules. Additional peaks can be observed due to impurities in the sample and it can be compared with that of standard raw material. By also measuring the absorbance at specific wavelength, the impurities can be detected. It is also useful in the structure elucidation of organic molecules, such as in detecting the presence or absence of unsaturation, the presence of hetero atoms.

5. TD-GC-MS/MS



Gas chromatography-mass spectrometry (GC-MS) is the separation technique of choice for smaller volatile and semi-volatile organic molecules such as hydrocarbons, alcohols and aromatics, as well as pesticides, steroids, fatty acids and hormones, making this analytical technique common in many application areas and industry segments, particularly for food safety and environmental testing. GC-MS can be also used to separate complex mixtures, quantify analytes, identify unknown peaks and determine trace levels of contamination. GC-MS can also used to study liquid, gaseous or solid samples. Analysis begins with the gas chromatograph, where the sample is effectively vaporized into the gas

		phase and separated into its various components using a capillary column coated with a stationary (liquid or solid) phase.
		6. HPLC  High-performance liquid chromatography or high-pressure liquid chromatography (HPLC) is a chromatographic method that is used to separate a mixture of compounds in analytical chemistry and biochemistry so as to identify, quantify or purify the individual components of the mixture. HPLC has many applications in both laboratory and clinical science. It is a common technique used in pharmaceutical development, as it is a dependable way to obtain and ensure product purity. Both quantitative and qualitative analysis can also be done. HPLCs can be used in the various applications such as water purification, separation of component from real sample such environmental water, food, vegetable, plant, soil and biological samples, detection of impurities in pharmaceutical industries, pre-concentration of trace components, ligand-exchange chromatography, ion-exchange chromatography of proteins, high-pH anion-exchange chromatography of carbohydrates and oligosaccharides.
		7. Zeta Sizer  Zeta potential is a measurement based on the charges on the particles in a suspension or emulsion. A zeta potential analyzer does the measurements

		and calculations to ascertain the zeta potential of a given material. Zeta potential analyzers are used by the ceramics, electronic and pharmaceutical industries to determine the stability of their suspensions and emulsions. The higher the zeta potential, the more stability the product has. Applying an electric field and measuring the velocity of charged particles and using ultrasound waves to create motion and then measure the electric charge of the moving particles are two methods used by zeta potential analyzers. Some features to keep in mind when comparing zeta potential analyzers include the type of liquids to be analyzed, particle size range that can be measured, the zeta potential range that can be measured, and the sample volume that can be accommodated.
		8. C, H, S, N/O analyzer  The C, H, S, N/O Analyzer find utility in determining the percentages of Carbon, Hydrogen, Nitrogen, Sulphur and Oxygen of organic compounds, based on the principle of "Dumas method" which involves the complete and instantaneous oxidation of the sample by "flash combustion". The combustion products are separated by a chromatographic column and detected by the thermal conductivity detector (T.C.D.), which gives an output signal proportional to the concentration of the individual components of the mixture. It brings a new level of precision, accuracy, speed of analysis and ease of operation. The built in chromatographic column converts the compound and elutes it in the form of NO_2, CO_2, SO_2, H_2O, which are then detected with the help of Thermal Conductivity Detector.
		9. Surface tensiometer

A tensiometer as it applies to physics is a measuring instrument used to measure the surface tension of liquids or surfaces. Tensiometers are used in research and development laboratories to determine the surface tension of liquids like coatings, lacquers or adhesives. A further application field of tensiometers is the monitoring of industrial production processes like parts cleaning or electroplating. Surface tension measurements are done using either force or optical tensiometers. Surface tension is an important parameter in many industrial processes which makes its measurement mandatory for process and product optimization

Surface tension measurements are widely used in many industrial areas as it has a direct effect on the spreading of the coating formulation and it's used to characterize surfactant solutions among others.

10. Fluorescence spectrophotometer

Fluorescence spectrophotometry is a set of techniques that deals with the

		measurement of fluorescence emitted by substances when exposed to ultraviolet, visible, or other electromagnetic radiation and structural characterization of carbon nanotubes. The peak excitation and emission wavelengths of semiconducting single-walled nanotubes are in the near-infrared (NIR), and depend on their diameter and chirality. Acquiring the fluorescence intensity as a function of both wavelengths yields an excitation-emission map, which reveals all the different types of nanotubes that are present in the mixture and their relative abundance. This technique is very simple and fast, and is often used to check the purity of carbon nanotube dispersions. Examples of the use of fluorescence spectroscopy include the study of fluorescent dyes that are widely used with biological samples, both in routine assays and in advanced research. It is also employed in material science to characterize luminescent materials. The applications of fluorescence spectroscopy are almost as wide as one's imagination.
		11. Tube Furnace and Refrigerated centrifuge A tube furnace is an electric heating device used to conduct syntheses and purifications of inorganic compounds and occasionally in organic synthesis. The eponymous component in a tube furnace is the heating chamber. This is comprised of a circular furnace wall made of high-temperature ceramic; either formed from a full cylindrical element or two semi-cylindrical elements that close to form a single void. Refractory heating coils or ribbons are embedded into the ceramic to surround a central chamber with uniformly distributed heaters. This architecture guarantees the highest possible thermal uniformity for processing both inorganic and organic compounds. Typical applications of tube furnaces include the purification, coating, drying, hardening or ageing of samples. Among other uses, a tube furnace can also be used for annealing, brazing, calcination, degassing, sintering, soldering, sublimation, synthesis, and tempering. Refrigerated centrifuge can be used for separation of organic and inorganic nanomaterial with high RPM.
		12. UV-Vis. spectrophotometer with integrated sphere  An integrating sphere is a spherical cavity whose inner wall is coated with

		a highly reflective material such as barium sulfate. In an integrating sphere, light undergoes multiple reflections so that the intensity becomes uniform, and some part of this reflected light enters the detector. The presence of a sample can change the optical path, as in the cases of scattering due to sample turbidity, non-planar samples, and thick samples. An integrating sphere is indispensable when the position and size of the light beam received by the detector changes due to a change in the optical path, and the transmittance cannot be measured. Application areas range from surface characterization of solids to the photometric analysis of turbid, colloidal, transparent and translucent samples. Typical uses encompass quality assurance testing and product development measurements on textiles, dyes, paper and glass. UV-Vis spectrophotometry with integrated sphere can also be used for the characterization of solar cells, analysis of security ink, color analysis, distinction between specular and diffuse reflectance, concentration determine of dyes in solid and liquid sample surface and determination of food constituents.
		13. Electrochemical workstation  An electrochemical workstation has a potentiostat and relevant control software on one end, and the electrochemical cell setup generally inside a Faraday cage on the other. Gamry has electrochemical cells for general, as well as specific, experiments. Under the following research work can be design based on electrochemical workstation: ✓ Electrochemical detection of analytes ✓ Sensor ✓ Super capacitor study ✓ Electrochemical synthesis ✓ Photoelectrochemical sensing/catalysis ✓ Solar cell performance
		14. Fluorescence Microscopy

		 A fluorescence microscope is an optical microscope that uses fluorescence and phosphorescence instead of, or in addition to, reflection and absorption to study properties of organic or inorganic substances. A fluorescence microscope is much the same as a conventional light microscope with added features to enhance its capabilities. The conventional microscope uses visible light (400-700 nanometers) to illuminate and produce a magnified image of a sample. A fluorescence microscope, on the other hand, uses a much higher intensity light source which excites a fluorescent species in a sample of interest. This fluorescent species in turn emits a lower energy light of a longer wavelength that produces the magnified image instead of the original light source. These microscopes are often used for imaging structural components of small specimens, such as cells, conducting viability studies on cell populations, imaging the genetic material within a cell (DNA and RNA), and viewing specific cells within a larger population with techniques such as FISH.