

# **Shivaji University, Kolhapur**

## **Contact Details For Instrumentation Facility in Shivaji University Kolhapur**

**Prof. (Dr.) Sagar D. Delekar**

**Coordinator,**

**University Industry Interaction Cell,**

**Email id: [sddelekar7@rediffmail.com](mailto:sddelekar7@rediffmail.com),**

**[sddelekar7@gmail.com](mailto:sddelekar7@gmail.com)**

**Contact No: 9890291575**

# Physics Instrumentation Facility Centre (PIFC)

At

Department of Physics,  
Shivaji University, Kolhapur



# Field Emission-Scanning Electron Microscope (FESEM)



**Scheme: DST-FIST (2002-07)**

**Cost: Rs. 1.70 Cr**

**Make: TESCAN Ltd., Czech Republic.**

**Model: MIRA3**

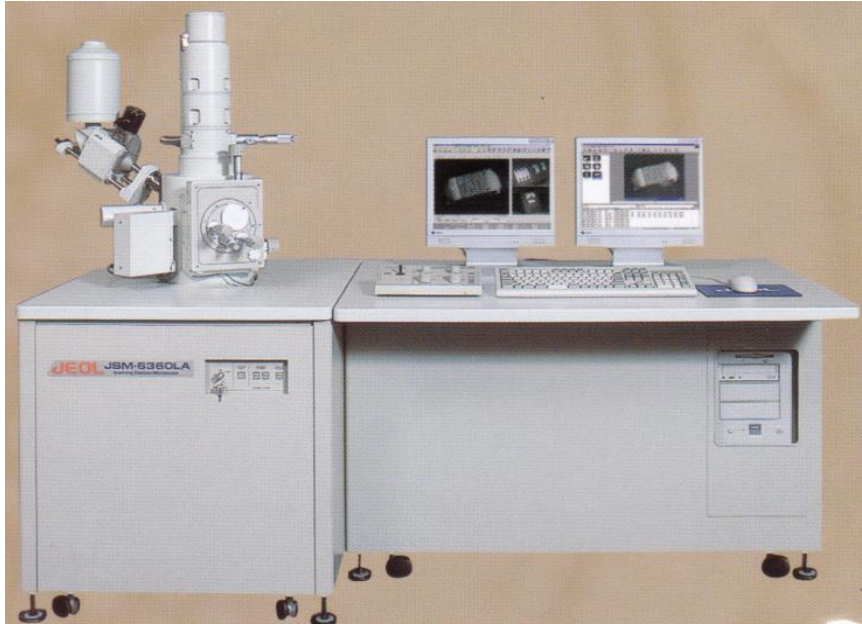
## Specifications:

### Specific Parameters

System type	Fully Integrated PC
Resolution	2 nm at 10kV
Photo magnification	2X to 1,000,000X
Operating voltage	200 V to 30kV

**Application:** IRA3 offers faster image acquisition, an ultra-fast scanning system, dynamic and static compensation and built-in scripting for user-defined applications.

# Scanning Electron Microscope (SEM)



**Scheme: DST-FIST (2002-07)**

**Cost: 47,72,825/- Rs**

**Make: Jeol Ltd., Japan.**

**Model: JSM 6360 A**

## Specifications:

### Specific Parameters

System type	Fully Integrated PC
Resolution	3 nm at 30kV
Photo magnification	30X to 1,00,000X
Operating voltage	500 V to 30kV

**Application:** SEM produces images of Powder, Thin films, thick films and pellets of materials.

# X-Ray Diffraction (XRD) (2)



**Scheme: UGC-DSA I (2010-15)**

**Cost: 50, 00, 000/- Rs**

**Make: Bruker, Germany.**

**Model: D2 Phaser**

## **Specifications:**

### **Specific Parameters**

Operating temperature	5-35°C
Scanning range	-3 to 160°
Target	Cu ( $\lambda=1.54\text{\AA}$ )
Detector	LYNXENE
Min. Step Size	0.005°

**Application:** The D2 PHASER is the most compact and fastest, all-in-one amorphous and crystalline phase analysis tool.

# Fourier transform Raman spectroscopy (FT-Raman)

**Scheme: UGC-ASIST I (2005-10)**

**Cost: 52,00,000/- Rs**

**Make: Bruker , Germany.**

**Model: Multi-RAM**

## Specifications:

### Specific Parameters

Spectral range	3600-36 $\text{cm}^{-1}$
Wavelength	1064 nm
Resolution	0.5 $\text{cm}^{-1}$
Detector	ND-YAG
Geometries	Both 180° & 90°

**Application:** The intuitive, easy-to-use OPUS software controls all data collection and manipulation functions for the Multi-RAM Stand Alone FT-Raman Spectrometer.





# Electrochemical workstation: IMPS and IMVS



**Scheme: DST-FIST-II**

**Cost: 37,00,000/- Rs**

**Make: Metrohm, Switzerland**

**Model: Autolab 302N with 32 FRA**

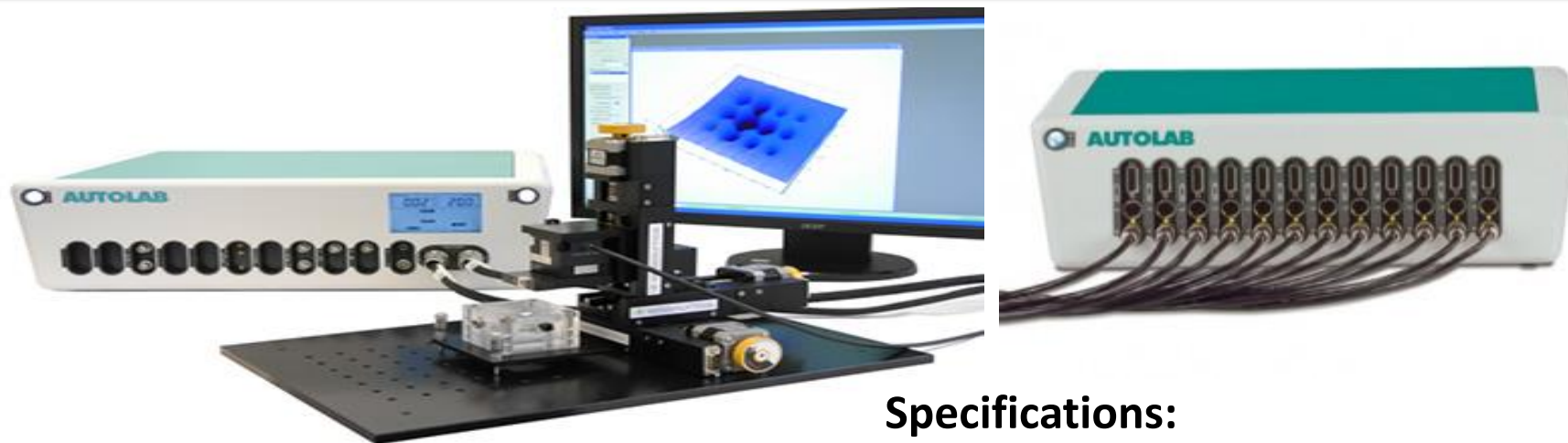
## Specifications:

### Specific Parameters

Compliance voltage	$\pm 30$ V
Resolution	20 $\mu$ V
Current	$\pm 10$ nA-1A
Frequency	10 $\mu$ Hz to 32 MHz

**Application:** In situ spectral measurement, Electrochemical characteristics

# Scanning Electrochemical Microscope (SECM)



## Specifications:

**Scheme: DST-FIST-II**

**Cost: 35,00,000/- Rs**

**Make: Metrohm, Switzerland**

**Model: Autolab 302N with 32 FRA**

**Sensolyte 0.045**

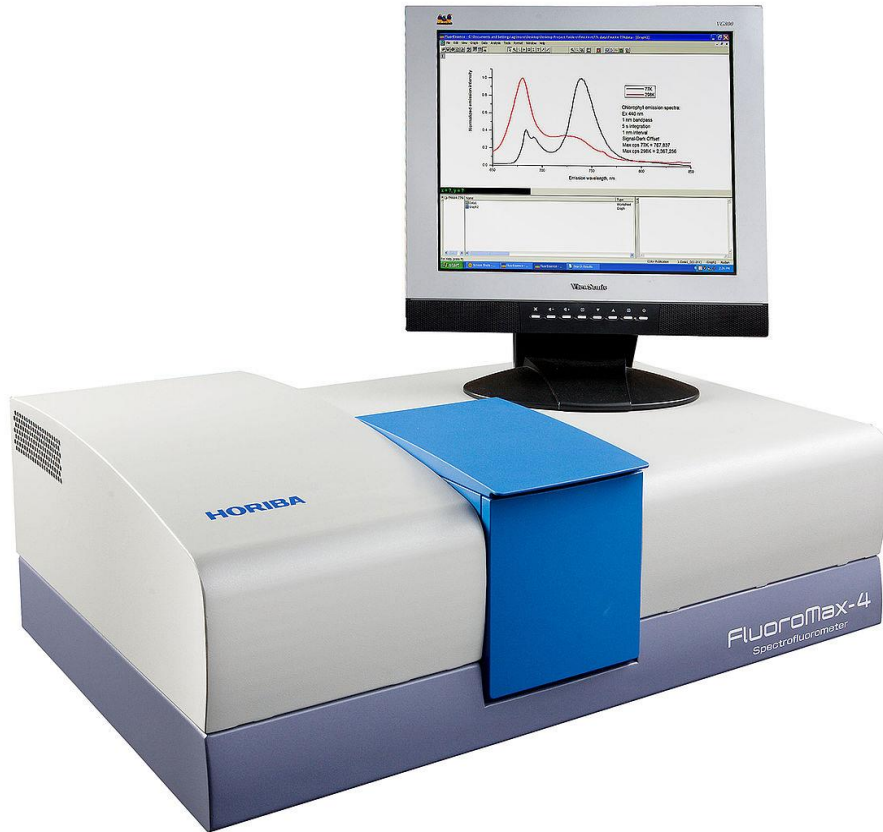
## Specific Parameters

Compliance voltage	$\pm 30$ V
Resolution	20 nm with CCD
Current	$\pm 10$ nA-1A
Frequency	10 $\mu$ Hz to 32 MHz
Working area	3.5 $\times$ 2.5 $\times$ 2.5 cm

**Application:** Offers interface reaction, living cell imaging, surface patterning, electron transfer kinetics, electrocatalysis etc.



# Photoluminescence (PL)



**Scheme: DST-PURSE (2010-13)**

**Cost: 26,35,000/- Rs**

**Make: Horiba Instruments, Japan.**

**Model: Fluoromax 4**

**Specifications:**

## Specific Parameters

Excitation	Fully Integrated PC
Emission	3 nm at 30kV
Band pass	30X to 1,00,000X
Lifetime range	200 ps to 0.1 ms
Scan speed	80 nm/s

**Application:** offers the ultimate sensitivity in fluorescence investigations as well as features table-top fluorescence detection systems.

# Atomic Force Microscope (AFM)



**Scheme: UGC-DSA I (2015-15)**

**Cost: 38,50,000/- Rs**

**Make: Bruker Instruments, Germany.**

**Model: Innova 1B3BE**

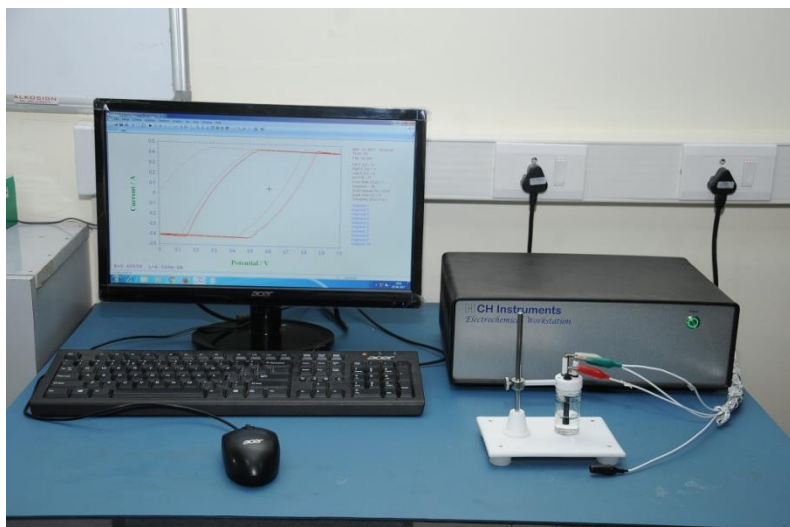
## Specifications:

### Specific Parameters

Modes	Contact and Tapping
X-Y Scan rate	1-90 $\mu\text{m}$
Z Scan rate	50-7.5 $\mu\text{m}$

**Application:** Innova offers a unique, state-of-the-art closed-loop scan linearization system that ensures accurate measurements and noise levels approaching those of open-loop operation.

# Quartz crystal microbalance



**Scheme: DST-FIST (2002-07)**

**Cost: 10,00,000/- Rs**

**Make: CH Instruments, U.S.A.**

**Model: 400 B (Time resolved)**

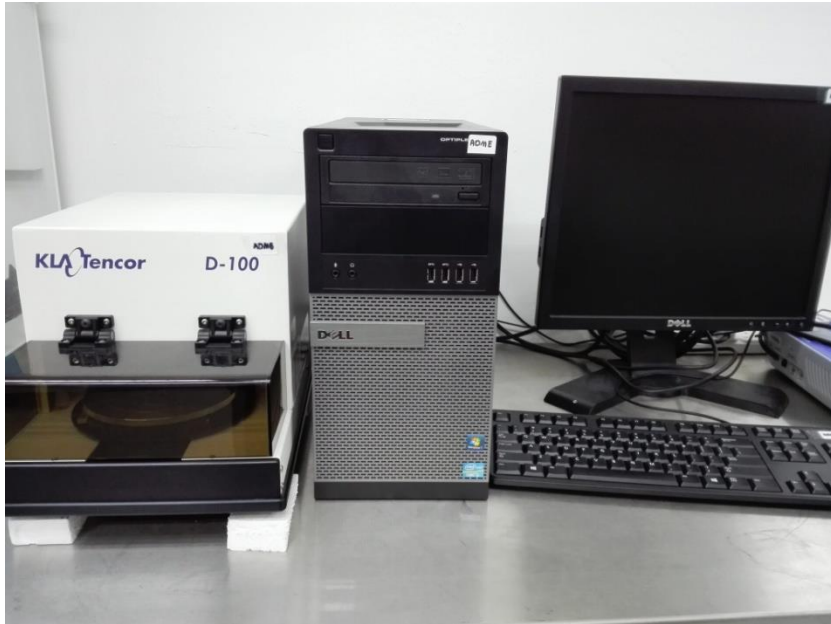
## Specifications:

### Specific Parameters

Potential range	-10 to 10 V
Compliance voltage	$\pm 12$ V
Current resolution	0.01 pA
Current range	0-250 mA

**Application:** The quartz crystal microbalance (QCM) is a variant of acoustic wave microsensors that are capable of ultrasensitive mass measurement.

# Surface profiler



**Scheme: DST-FIST (2002-07)**

**Cost: 15,36,243/- Rs**

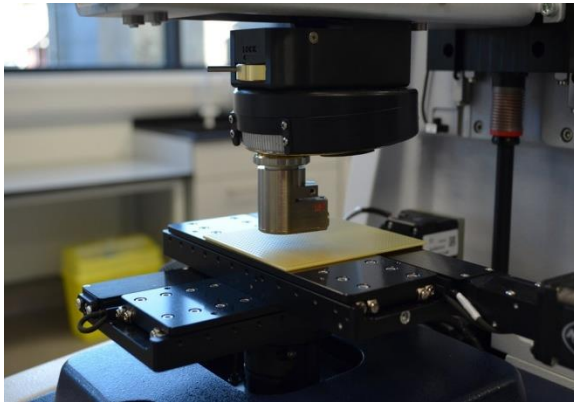
**Make: Ambios technology, U.S.A.**

**Model: XP-1**

## Specifications:

### Specific Parameters

Vertical resolution	1.5 Å
Calibration	Laser
Lateral resolution	100 nm
Lateral length	200 nm



**Application:** The Surface profiler offers 2D topography of surface with 30mm scan length.

# Solar Simulator



**Scheme: DST-PURSE (2010-13)**

**Cost: 36,37,000/- Rs**

**Make: Photo emission tech., U.S.A.**

**Model: CT 150 AAA**

## Specifications:

### Specific Parameters

Lamp power	1000 W
Illumination area	25×25 cm <sup>2</sup>
Air mass	AM0, AM1, AM 1.5
Intensity	100 W/ cm <sup>2</sup>

**Application:** The Surface profiler offers 2D topography of surface with 30mm scan length.

# Electrochemical Impedance spectrometer (EIS)



**Scheme: DST-PURSE (2010-15)**

**Cost: 16,35,000/- Rs**

**Make: WonATech. S. Korea.**

**Model: Zive SP5**

## Specifications:

### Specific Parameters

Frequency	10 $\mu$ Hz to 1 MHz
Amplitude	1 mV to 1V
channels	Multi-channel
Current	2A to 20 pA

**Application:** Battery/ supercapacitor studies, electrochemical depostion and Impedance studies.



# Thermal conductivity



**Scheme: UGC-DRS (2000-05)**

**Cost: 4,00,000/- Rs**

**Make: Teleph Instruments, France.**

**Model: SA BP 113**

## Specifications:

### Specific Parameters

Range	Low temperature
Power	0.001-10 W/mK

**Application: Specific heat and thermal conductivity of various materials.**

# LCR meter



**Scheme: UGC-DRS (2000-05)**

**Cost: 2,00,000/- Rs**

**Make: Hewlett Packard, .**

**Model: 4284 A**

## Specifications:

### Specific Parameters

Parameters	L, C, R, D, X $\theta$
Impedance range	0.1 m to 99 M $\Omega$
Frequency	20 Hz to 1MHz

**Application: Power measurement, capacitor, CV analysis and dielectric measurement.**

# Spray-CVD instrument

**Scheme: UGC MRP 2015-2018**

**Project Cost: Rs. 14,20,000/-**

**Name of PI: Prof. P. S. Patil**

**Make: Home Made**

**Cost of the instrument: Rs. 2,00,000/-**

## Specific Parameters

Max Operating temperature	1100 °C
Hot Zone length	50 cm
Number of Steps per Program to control temp.	31

**Application:** To deposit thin films of Metal oxide, Metal chalcogenide and Transparent Conducting Oxide



# Two Zone Furnace

**Scheme: UGC MRP 2015-2018**

**Project Cost: Rs. 14,20,000/-**

**Name of PI: Prof. P. S. Patil**

**Make: Ants ceramics Pvt. Ltd.**

**Cost of the instrument: Rs. 1,70,000/-**

## Specific Parameters

Max Operating temperature	1100 °C
Hot Zone length	15 cm each zone
Hot Zone diameter	4 cm
Number of Steps per Program to control temp.	31



**Application:** To sulfurize metal chalcogenide thin films, annealing in inert gas atmosphere and to synthesize CNT.

# UV-VIS-NIR Spectrophotometer

**Scheme: UGC 2015-2018**

**Name of PI: Prof. P. S. Patil**

**Make: Shimadzu Instruments, Japan.**

**Cost of the instrument: Rs. 7,00,000/-**

## **Specifications:**

<b>Specific Parameters</b>	
Wavelength	190-1100 nm
EM region	UV, VIS and NIR
Accuracy	0.1 nm
Bandwidth	1nm



**Application:** measures the absorbance or transmittance at a single wavelength or at multiple wavelengths..

# Surface area Analyzer using BET



**Scheme: CSIR (2012 - 15)**

**Name of PI: Prof. P. S. Patil**

**Make: Quantachrome**

**Cost of the instrument: 13,00,000/-**

## **Specifications:**

### **Specific Parameters**

Operating temperature	25 – 300 °C
Surface area range	0.01 m <sup>2</sup> /g
Pore size range:	0.35 to >500nm
Minimum pore volume:	(STP) 0.0001 cc/g

**Application:** Quantachrome Nova e1000 is the most compact used to measure surface area, average pore size, and pore volume, of all powder samples.



**Central Facility Centre (CFC),  
Shivaji University, Kolhapur**

# Thermal Analyzer (DSC TGA)

**Scheme: XI<sup>th</sup> Plan**

**Cost: 18,000,00/- Rs**

**Make: TA Instruments.**

**Model: SDT 650**



## Specifications:

Operating temperature	Up to 1500°C
Dynamic Temperature Precision	± 0.5°C
Heating Rate	0.1 to 100 °C/min
Sample Weight Capacity	200 mg

**Application: To study the thermal decomposition rate of material.**

# Microwave Digestion System

**Scheme: SAIF**

**Cost: 16,95,000/- Rs**

**Make: Anton Paar**



## Specifications:

Number of vials	18
Sample amounts (organic)	up to 1 g
Rec. filling volume	10 mL
Vial	Quartz, Glass

**Application:** used to dissolve heavy metals in the presence of organic molecules prior to analysis by inductively coupled plasma, atomic absorption, or atomic emission measurements.

# Particle size Analyzer with Zeta Potential



**Scheme: SAIF**

**Cost: 25,14,310/- Rs**

**Make: Malvern**

**Model: Zetasizer Nano ZS90**

## Specifications:

Size measurement	0.3nm to 5 microns
Molecular weight measurement	9,800Da – 20M Da
Source	He-Ne laser 633nm, Max 4mW
Temperature range extension option	Up to 120°C

**Application: To measure the particle size, molecular size and molecular weight.**

# Gas Chromatograph-Mass Spectrometer with Head Space sampler

**Scheme: SAIF**

**Cost: 1,18,22,419/- Rs**

**Make: Shimadzu**

**Model: GCMS-TQ8050**

**HS-20**



## Specifications:

Headspace vials	10-mL and 20-mL
Maximum equilibration temperature	300 °C

**Application: analysis and detection even of tiny amounts of a substance.**

# Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES)



**Scheme: SAIF**

**Cost: 39,10,684/- Rs**

**Make: Agilent**

**Model: 5110**

## Specifications:

wavelength range	167 to 785 nm
Image Mapping	VistaChip II CCD detector
Sample to Sample time	22 to 52 sec
Control	Through ICP Expert software

**Application: To determine concentration of the trace element within the sample.**



# FTIR Spectrometer

**Scheme: XII<sup>th</sup> Plan**

**Cost: 10,03,466/- Rs**

**Make: Bruker**

**Model: ALPHA**



## Specifications:

Sampling module	2x3" standard sample holder
Infrared source	Diode Laser
Spectral range	500 – 6,000 $\text{cm}^{-1}$
Wavenumber accuracy	$<0.05 \text{ cm}^{-1}$ @ 2000 $\text{cm}^{-1}$
Detector	High sensitivity DLATGS

**Application: To verify the identity and specifications of raw materials and products.**

# Gas Chromatograph-Mass Spectrometer

**Scheme: X<sup>th</sup> Plan**

**Cost: 25,07,105/- Rs**

**Make: Shimadzu**

**Model: GCMS-QP2010**



## Specifications:

Oven temperature	Up to 450°C
Injector port temp	Up to 450°C
AFC pressure range	0 to 970 kPa
Detector	Secondary electron multiplier with overdrive lens and conversion dynode
High-speed scan rate	20,000 u/sec

**Application: To verify the identity and specifications of raw materials and products.**

# Transmission electron microscope (TEM)



**Application: To study material morphology with fine detail.**

# X-ray photoelectron spectrometer(XPS)



**Application: To measure the elemental composition, empirical formula, chemical state and electronic state of the elements that exist within a material.**

# Micro Raman spectrometer



**Application: To observe vibrational, rotational, and other low-frequency modes in a system.**

# Bio-AFM



**Application: To measure the mechanical properties of living material.**

# Ultracentrifuge



**Application: used in analysis of biological samples.**

# Vector Network Analyzer



**Application: To measure the network parameters of electrical networks.**

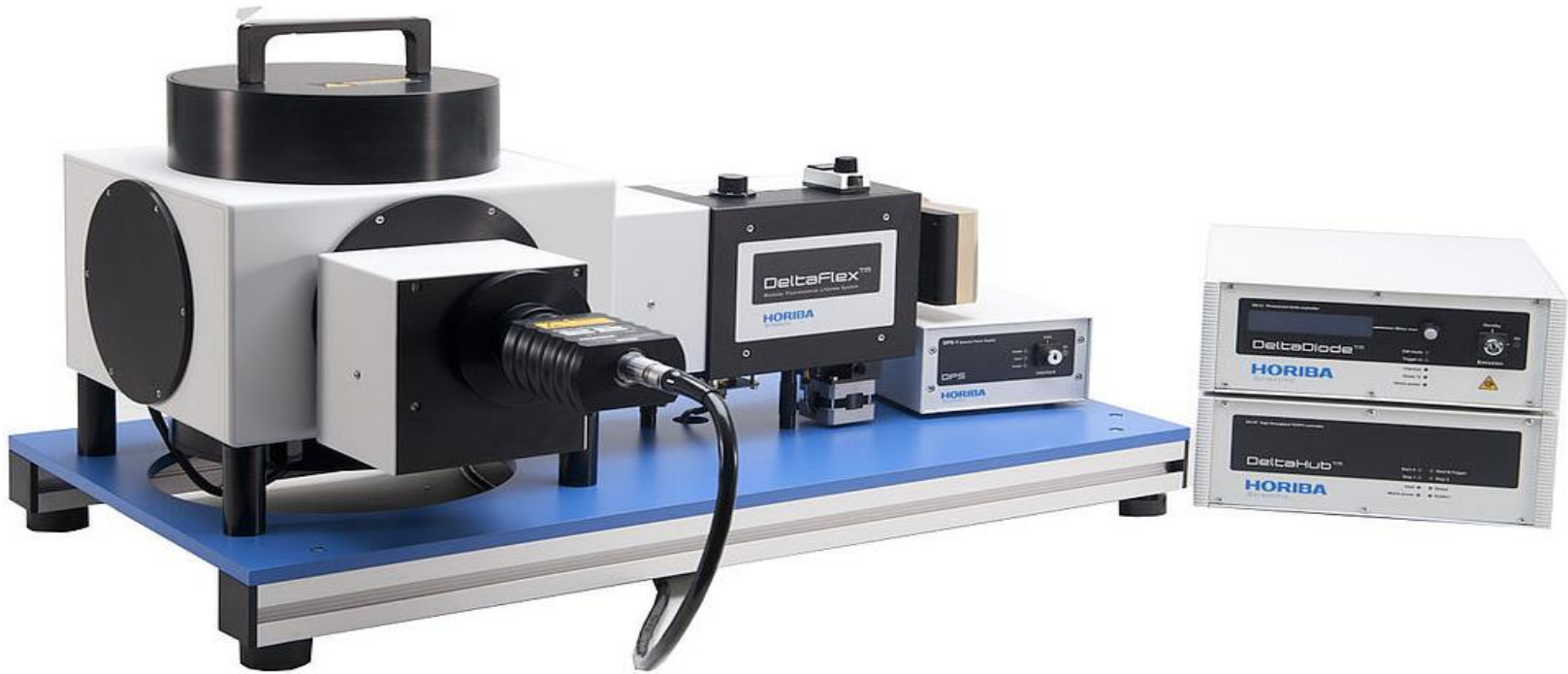


# Small Angle X-ray Scattering System (SAXS)



**Application: To determine nanoparticle size distributions, resolve the size and shape of (monodisperse) macromolecules, determine pore sizes, characteristic distances of partially ordered materials.**

Sophisticated Instrumentation Facility  
at  
Chemistry Department



## **Time resolved photoluminescence spectroscopy, (HORIBA)**

### **Applications:**

- ✓ **Interfacial charge carrier recombination rate**
- ✓ **Life time measurement**



## **BET analysis, Nova, 1000e Quanta Chrome**

### **Applications:**

- ✓ **To determine the surface area**



## **DLS, Particle Size analyzer, NanoPlus**

### **Applications:**

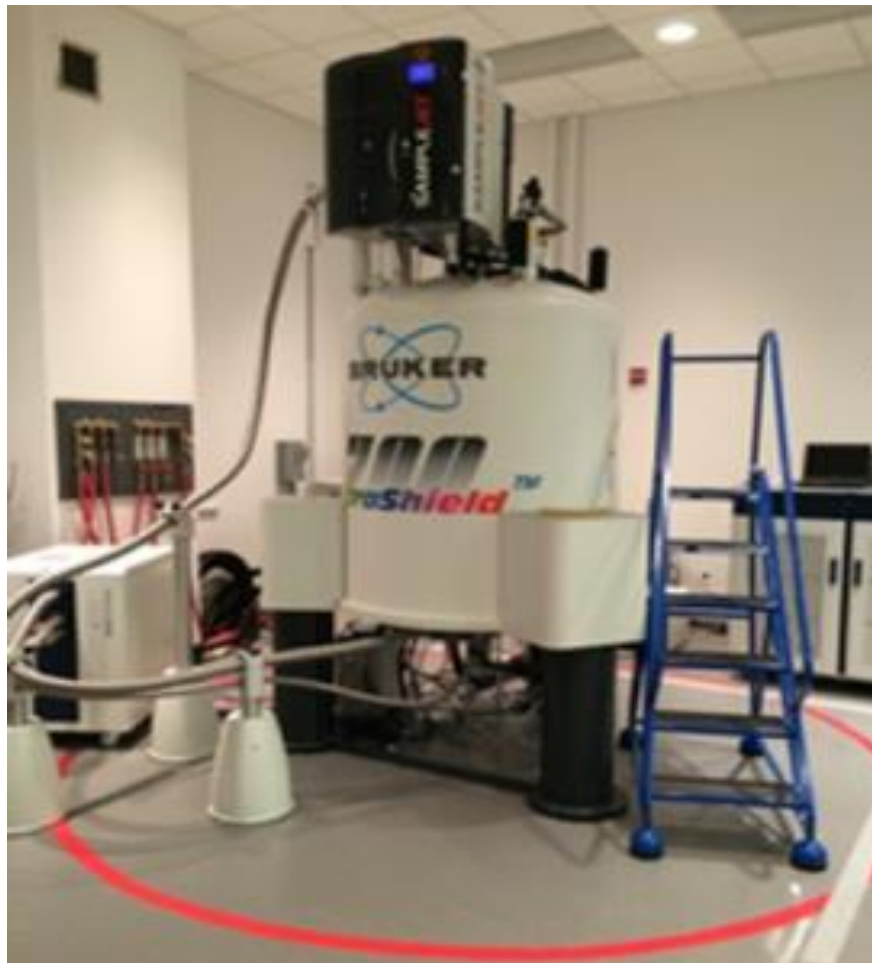
- ✓ **Electrostatic repulsion and effective surface charge**
- ✓ **Zeta potential**



## **FTIR, Perkin Elmer**

### **Applications:**

- ✓ **Structural elucidation**
- ✓ **Functional group determination**



## **NMR, Bruker 75 MHz**

### **Applications:**

- ✓ **To determine the structure of organic molecules in solution**
- ✓ **In advanced medical imaging technology**





## **DRS-UV Visible Spectroscopy, Labindia**

### **Applications:**

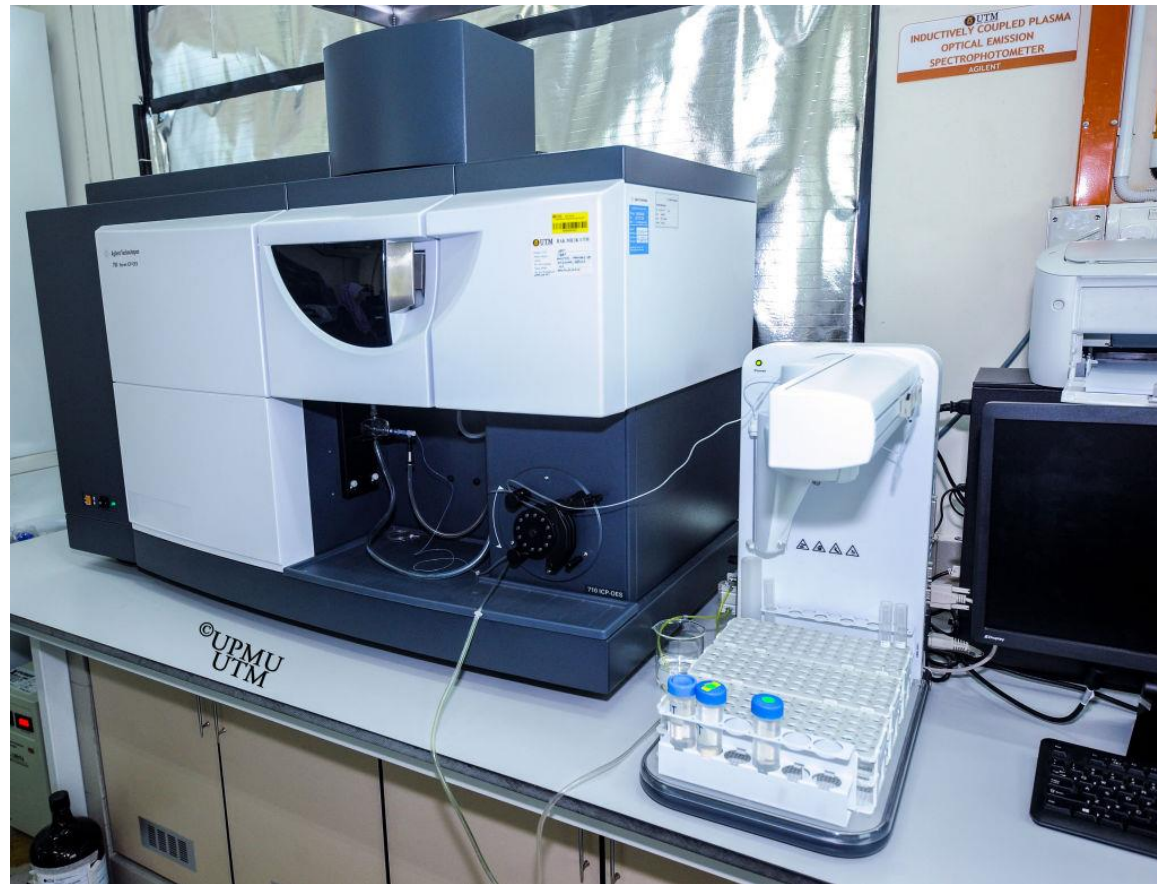
- ✓ **Quantitative determination of different analytes**
- ✓ **In semiconductor industry to measure the thickness**
- ✓ **To measure the optical properties of thin films**



## LCMS shimadzu

### Applications:

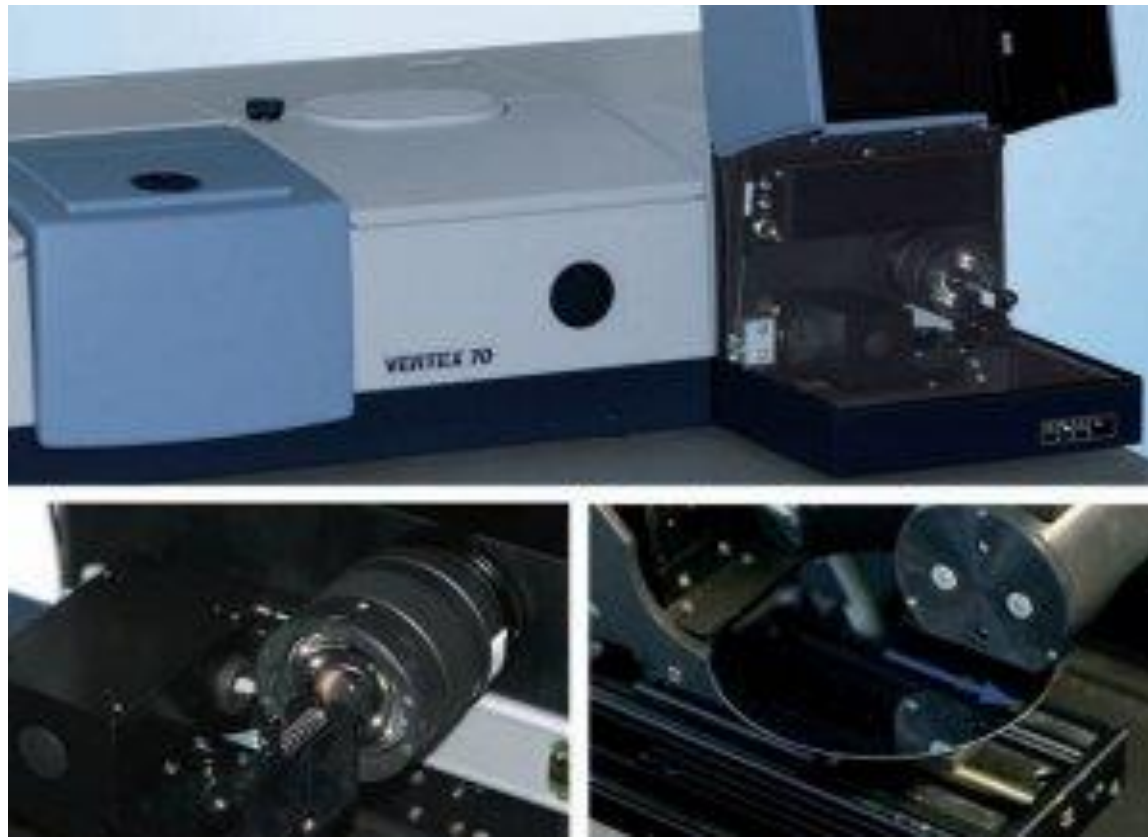
- ✓ In pharmaceutical Industry
- ✓ In biomedical chemistry,



## ICP-OES, Agilent 715

### Applications:

- ✓ Detection of trace metals in water, food, wine
- ✓ Widely used in minerals processing



## **Photoluminescence spectroscopy, FP-8300, JASCO**

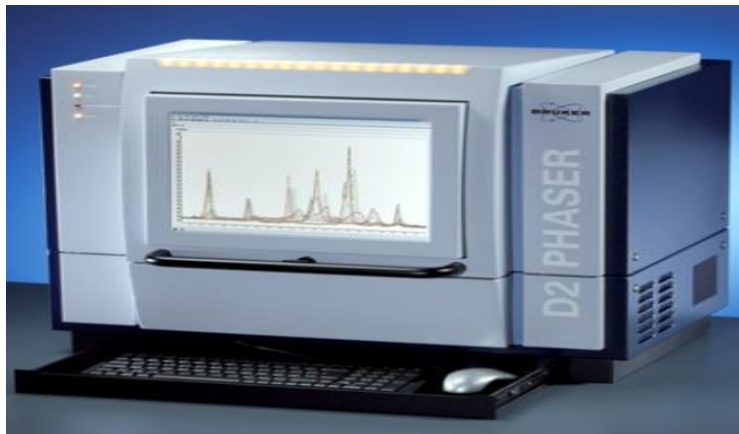
### **Applications:**

- ✓ **detection of light emission patterns**
- ✓ **To study the optical properties of semiconductor**



# Research Facilities at SNST

**X-ray Powder Diffractometer (@ PIFC-SUK)**



**Surface Area  
Analyzer BET**

**UV-VIS Spectrophotometer**



**Parallel Synthesizer**

# Research Facilities



**Spray Deposition Unit**



**Nano Fiber Electrospinning Unit**

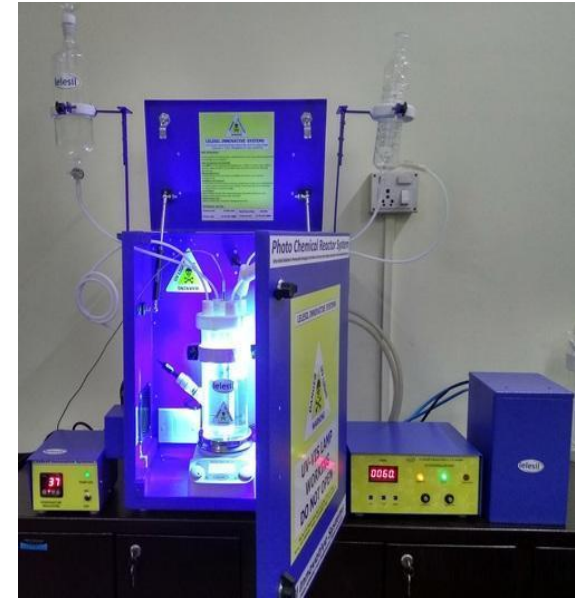
# Research Facilities



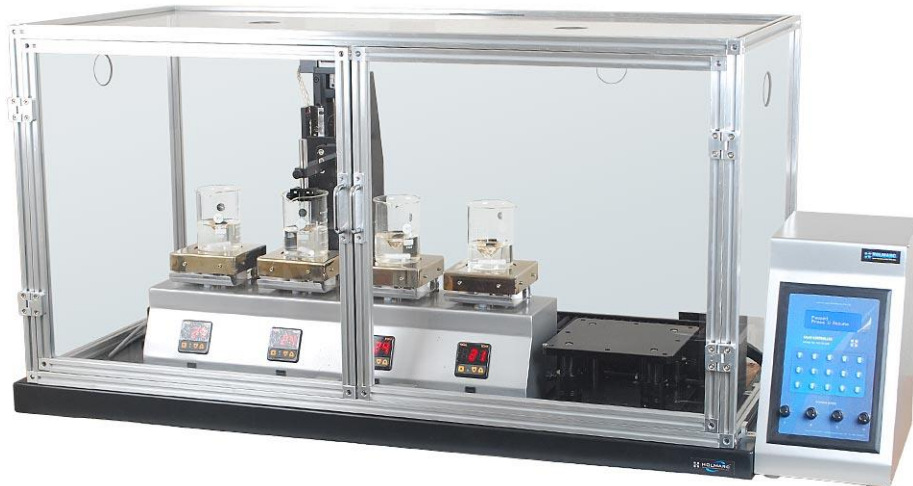
**Dip Coating Unit**



**Spin Coating Unit**



**Photoreactor**



**SILAR Coating System**



# Research Facilities



**Autoclave**



**PCR**



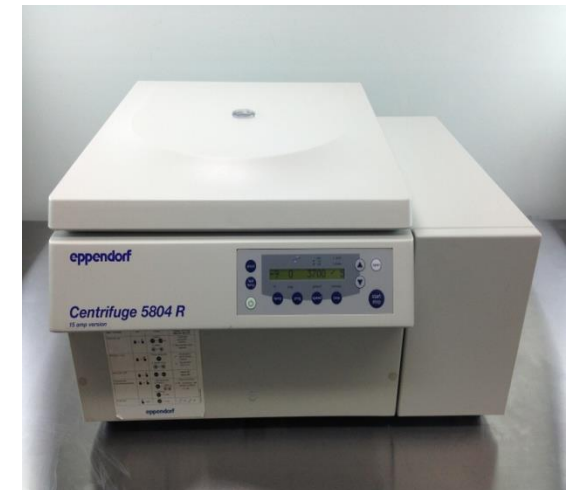
**Hot air oven**



**Microcentrifuge**



**Laminar Air Flow**



**Refrigerated multipurpose centrifuge**

# Research Facilities



**Shaking Incubator**



**Gel Doc Unit**



**Static Incubator**



**Shaking Water bath**

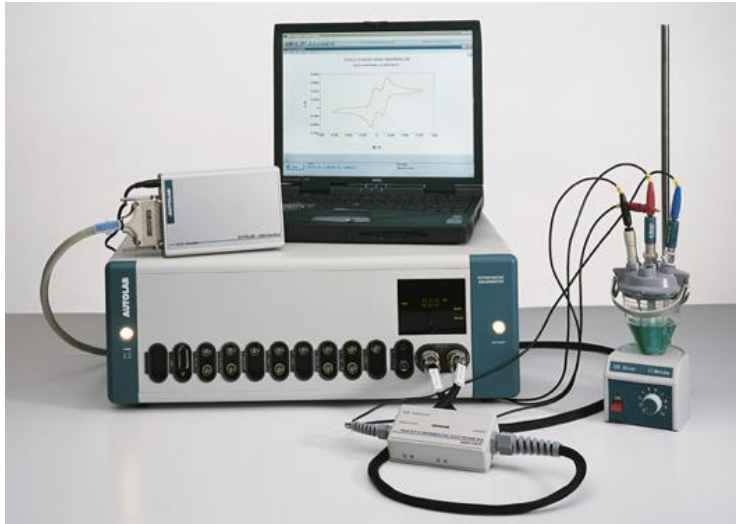


**-86 Deep freezer**

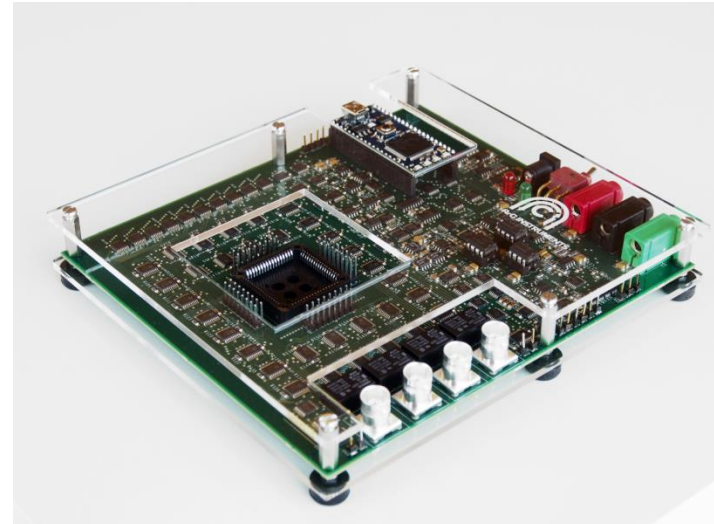


**Nano Drop**

# Research Facilities



**Electrochemical Workstation**



**Memristor Characterization System**



**Automated Protein Purification System**



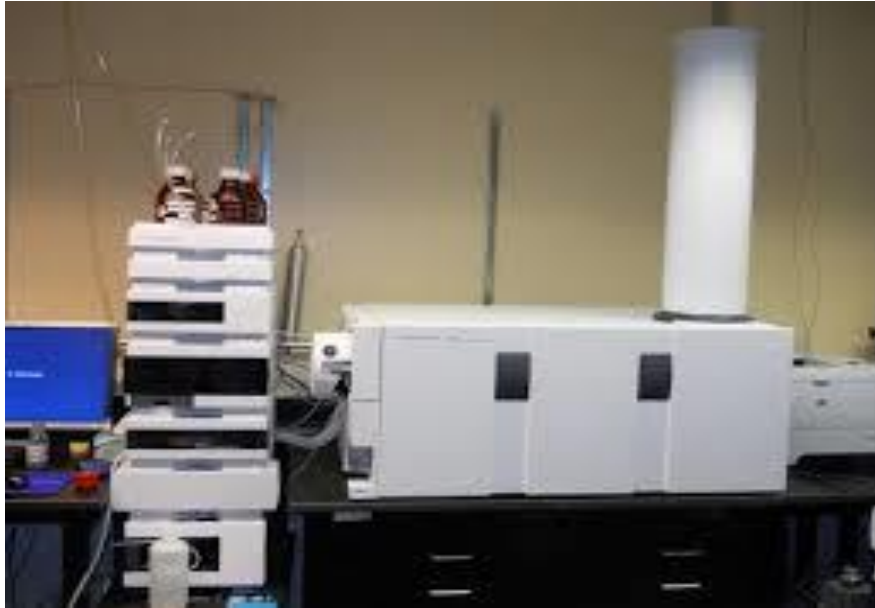
**Contact Angle Meter**



**Chemical Vapour Deposition**

# Research Facilities

## Liquid Chromatography–Mass Spectrometry (LC MS-MS)



## Surface Plasmon Resonance



Dept. of Biotechnology, SUK





**Thank you....**