Centralized instrument facility

1) Vibrating sample magnetometer
2) Bruker High resolution X-ray diffractometer
3) Perkin Elmer FTIR spectrometer with ATR & Specular reflectance
4) Agilent LCMS with Quadropole time of flight
5) Thermal analysis Perkin Elmer TGA, DTA and DSC
6) Waters Differential Scanning Calorimeter
7) Jeol 400 MHz Nuclear Magnetic resonance
8) TEM sample preparation equipment
9) Critical point dryer
10) Jeol scanning electron Microscope (SEM) with EDS
11) FEI High Resolution Transmission electron microscope (TEM)
12) CHNS Analyzer
13) Liquid nitrogen (LN2) storage tank and distribution facility
14) Renishaw Laser Raman Spectrometer
15) Cary Eclipse Fluorescence spectrophotometer (solid and liquid samples)
16) Time resolved Fluorescence spectrometer (Horiba Yvon)
17) Sentech Ellipsometer
18) Upconversion and downconversion fluorescence spectrometer
19) Linesis TGA with auto sampler
20) Thermo fisher FTIR spectrometer with FIR attachment
21) Broadband Dielectric/impedance analyzer (mHz to 10 MHz)
22) Jasco Circular dichroism spectropolarimeter
23) B.E.T. surface area analyzer
24) Zeiss FESEM
25) Single crystal X-ray diffractometer
26) Nikon confocal microscope
1) **Vibrating sample magnetometer**

Make: Microsense, Model ADE – EV9  
Specifications:  
- Magnetic field: Up to 2.2 Tesla  
- Field resolution: $1 \times 10^{-3}$ Oe  
- Sensitivity: $5 \times 10^{-5}$ emu  
- Temp. variation: 100 to 1000K  
- Magneto resistance (Between 1 and 10,000 Ω)  

**Measurements:**  
- Virgin curve, Hysteresis loop  
- Isothermal remanence  
- DC demagnetization  
- Angular remanence  
- Temperature scan

---

2) **High resolution X-ray Diffractometer**

Make: Bruker, D8 Discover,  
X-ray source Cu, 3KW  
Specifications:  
- Sample stage Eulerian cradle with 6 degrees of freedom, Optical system: 2D area detector, scintillation detector,  
- Powder diffraction, Rocking curve, X-ray reflectometry, grazing incidence diffraction measurements, and structure refinement,  
- High temperature attachment RT to 1500°C.  
- Low temperature attachment 77K to RT

---

3) **FT-IR spectrometer**

Make: Perkin Elmer  
Model: Spectrum RXI – Mid IR  
Specifications:  
- Range 400 to 4000 cm$^{-1}$  
- Resolution 1 cm$^{-1}$  
- Source: Nichrome wire  
- Detector: Lithium Tantalate  
- Beam splitter: KBr  

Accessories: HATR and Diffuse reflectance.  
Analysis of powder, gel, paste, emulsion, pure liquid, solution and polymer films.
4) **High resolution liquid chromatography Mass spectrometer with Quadrupole Time-of-flight**  
Make: Agilent G6530AA (LC-HRMS-Q-TOF)  
Specifications:  
Source – ESI and APCI source.  
Mass accuracy: > 2ppm  
HPLC pressure: 600 Bar, MS pressure: $10^{-4}$ to $10^{-5}$ Torr  
Resolution: 20,000  
**Features:** Molecular formula determination, Accurate molecular weight determination, molecular structure determination, and Reaction kinetic studies.  
Agilent Jet stream technology. Mass Hunter workstation data mining tools for high resolution accurate mass analysis.

5) **Thermal analysis (TGA/DTA)**  
Make: Perkin Elmer, Pyris diamond TGA/DTA  
Specifications: Range RT to 1100°C  

6) **Differential scanning calorimeter (DSC)**  
Make: Waters (TA instruments)  
Model: Q200 modulated DSC with mass flow control  
Operating Temp. range -90°C to 725°C  
Refrigerated cooling system -90°C to 550°C  
Sensitivity: 0.2 µW, Precision ±0.05°C  
Accuracy ±0.1°C  
Heating and cooling rate:  
Sample pan : Aluminum pans  
**Features:** Thermal conductivity (Modulated DSC) Isothermal kinetic studies, Purity measurements, and glass transition temperature.
7) **Nuclear magnetic Resonance**

Make: Jeol, Model: JNM-EXCP 400  
Specifications: 400 MHz FT NMR, 2 RF channels  
**Observable Nuclei:** Multinuclear, Full range  
1H, 13C, 19F all nuclei between 15N-31P  
Stability 0.1 Hz/hour ($^2$H internal lock used)  
Standard frequencies: $^1$H : 400 MHz, $^{13}$C:100 MHz  
Variable temp. facility: -140 to 180° C  
Gradient strength: 0.3T at 10Amp setting  
Auto sampler capacity 64 samples  
Sound proof air compressor  
Users submit samples in their own NMR tubes (5mm) with caps in the morning before 11:00 AM and collect the data in the evening.

8) **TEM sample preparation equipment**

Make: Gatan and Quorum Technologies  
1) Ultrasonic cleaner  
2) Diamond Saw blade dicing unit  
3) Gatan 601 Ultrasonic disc cutter  
4) Glass lapping discs with polishing paper  
5) Hot plate  
6) Gatan 656 Dimple grinder  
7) PIPS ion polishing machine  
8) Gold sputter coater and Carbon evaporator  
9) Oven (40 to 260°C)  
Users are expected to learn the operation of the above equipment and prepare their samples.

9) **Critical point dryer**

Leica Critical point dryer CPD 300 (installed)  
Fully reproducible process  
Possibility for storing and retrieving recipes and programs.  
Timer function, minimized Co2 consumption  
Flexibility in sample size  
Easy to use – intuitive software, with touch screen interface.
10) Scanning Electron Microscope
Make: JEOL Japan
Mode: High and Low vacuum mode
Electron Sources: Tungsten or LaB₆ filament
Voltage: 1-30KV
Magnification: X5 to X 3,000,000
Resolution: 3nm with High Vacuum mode
Peltier Stage: -25°C to +50°C
Gold sputter coater JEC 300
Detector: Secondary, Backscattered and LN₂ free EDS detector.
Features: Surface morphology, Topography, Elemental analysis with EDS, 3D analysis with 3D software.

11) Transmission Electron Microscope
Make: FEI Netherlands,
Model: Technai G²T30,U-Twin
Specifications:
Electron Source: Tungsten or LaB₆ filament
Voltage: 50-300 KV
Resolution: 0.19nm
Magnification: 58X - 970KX (TEM), 100X-5MX (STEM)
Camera Length: 80-5600mm
EDS solid angle: 0.13 steradians
Features:
Morphology of particles & particle size distribution, Elemental analysis & STEM,

12) CHNS Analyzer
Make: Elementar Analysensysteme Germany
Model: Vario Micro Cube
Specifications:
Simultaneous determination of CHNS, CNS, S in organic and inorganic solids and liquids. Oxygen determination – optional. Inhomogeneous, highly volatile and sensitive substances. Automatic sample feeder for max. 79 samples
Sample size = 0.02 – 1000mg
Combustion Temp: 950 to 1200°C (selectable)
Combustion Time: 0.1 to 6 min
Carrier gas : Helium
13) **Liquid Nitrogen storage tank and distribution**

- 950 liter Portacryo liquid nitrogen tank (rented)
- 600 liter SS cryogenic tank
- 200 liter Cryo container for NMR

**Liquid nitrogen distribution timings:**
- Monday: 10:30 to 12:30 noon
- Thursday: 2:30 to 4:30 PM

Liquid nitrogen supplier: M/s Star special gases

Users are requested to bring their own LN2 containers, and pay the charges for the Liquid nitrogen in advance at the Univ. cashier, and collect liquid nitrogen.

---

14) **Renishaw Laser Raman spectrometer**

Model: Invia II

**Specifications:**
- Source: 785 nm and 514 nm LASER
- Hi frequency 200 to 3200 cm\(^{-1}\)
- Low frequency 10 to 750 cm\(^{-1}\) using 514 nm
- Resolution – better than 1 cm\(^{-1}\)
- Confocal Raman microscopy
- Spot size < 10 µm
- Temperature variation -196°C to 200°C
- Solid and liquid samples, powders & thin films.

---

15) **Cary Eclipse Fluorescence spectrometer** (Liquid samples)

Source: Oxygen free 150 W Xenon lamp
- Plane grating Czerny-Turner design maintaining focus at all wavelengths
- Excitation: 200-950 nm, Emission: 200-950 nm
- Bandpass: Computer controlled 0 – 30 nm, continuously adjustable.
- Wavelength accuracy: ±0.5 nm at 541.92 nm ±1.0 nm at 200-950 nm
- Step size: 0.15 to 30 nm, Scan speed: 400 nm/s
- Integration time from 1 ms to 160
- Cuvette size: 4 ml, 1 cm path length,
- Quartz cuvette stoppered 250 µL micro quartz cell
16) **Time resolved Fluorescence**

Lifetime system with emission
Monochromator and diode excitation
UV pulsed LED source (280 and 370 nm)
Blue pulsed LED source (460 nm)
Green pulsed LED source (560 nm)
Metallic ND filter, Automated polarizer,
Quartz fluorescence cell with PTFE stopper

---

17) **SENTECH ELLIPSOMETER**

**Model No.:** SEN research SE 850 DUV Variable angle spectroscopic Ellipsometer

**Spectral Range:** 190-2300nm

**Motorized Goniometer:** 40°-90°, step with 0.01°

Fixed 150 mm Sample stage

**Temperature control stage:** 4K – 700K

Motorized Stage and Mapping Software

Video Camera Unit for sources Alignment

CCD Camera for Sample Alignment

**Light Source:** Deuterium for UV, Halogen Lamp for Visible and NIR range

**Spot Size:** 1-4mm

Micro spot of 200µ for UV-VISIBLE Range

Sample Holder for Transmission measurement
18) **Upconversion and downconversion fluorescence spectrometer**
Model QM-8450-11, Quanta master
450W Xe lamp, 1800l/mm grating
Cooled PMT detector R928 PMT
QM-400 Phos lifetime measurement
Computer controlled shutter
Nano LED 375, 250, 280, & 320 nm
7 longpass filters 330,395,455,495,550,590
980 nm 2W adjustable powder CW laser
Quanta-Phi 6” integrating sphere
Provision for Powders and liquid samples

19) **Linesis TGA with auto sampler**
- Model TGA HiRes1000
  RT to 1100C, Top loading
  Gas dosing possible, 2 gas MFC’s
  Heating rate 0.01 to 200 °C/min
  Forced air cooling
  Sample weight 2 gm
  Resolution 0.1 µg
  Auto sampler: 42 positions
  Temperature accuracy ±2°C
  Balance sensitivity : 0.5 µg
  Balance accuracy <1%
  Balance precision 1%
20) **Thermofisher FTIR spectrometer with FIR attachment**

- Nicolet iS50 FTIR Tri-detector
  Gold flex spectrometer – Gold optics (0.09 cm\(^{-1}\) resolution), Automated beamsplitter exchange MIR-FIR
- DLaTGS detector with KBR window
- Ge-on-KBr beamsplitter (7800-350 cm\(^{-1}\))
- is50 Build-in Diamond ATR module (5000 to 100 cm\(^{-1}\))

21) **Broadband Dielectric spectrometer**

Make: Novacontrol Technology
Dielectric/Impedance analyzer
Temp variation: -196° C to +300° C
Frequency range 10\(^{-3}\) Hz to 10\(^{7}\) Hz
Automatic data acquisition
Graphical online display of measured electrical parameters, temperature variation and system status. Automatic calibration of Hardware devices and sample cell. Optional curve fitting software – Win Fit.

22) **Circular Dichroism spectropolarimeter**

JASCO-CD POLARIMETER
MODEL: J-815(150-S)
Source : 150 W XENON ARC LAMP
Wavelength range : 163-900 nm
Wavelength accuracy : 0.2nm
Spectral bandwidth : 0.01-15nm
Scanning modes :Auto response, continuous, and step
Scanning speed : 1nm -10,000 nm /min.
UV measurement : 0-5Abs.
Rectangular cells of 1mm, 2mm,5mm 10 mm Path length
Simultaneous measurements of absorption spectra
Peltier Temp. Control unit
23) **BET surface area analyzer**

Make: Quantachrome Instruments  
Model: ASI-CI-11  
Adsorbate temperature 77 K  

User defined analysis for fast and simple measurement initialization.  
Automatic error checking

---

24) **Zeiss field emission scanning Electron microscope (FESEM)**

- Zeiss GeminiSEM 500  
  Thermal field emission type  
- Acceleration voltage 0.02 – 30kV  
- Probe current 3 pA – 20nA  
- Magnification 50 – 2,000,000  
- EDS detector  
- Angular selective backscattered detector  
- Inlens secondary electron detector  
- Everhart Thornley secondary electron
25) **Single crystal X-ray diffractometer**

**MAKE:** Oxford Diffraction  
**Model:** X-Calibur-S Single Crystal XRD  
4-Circle Kappa platform with enhanced X-ray source  
**X-ray Tube:** Ceramic Fine Focus (Mo/Cu)  
**Cryojet System:** 90-300K  
**Capillaries:** (Quartz with 0.2, 0.3, 0.5 & 0.7 mm OD)  
Sapphire CCD Detector: (2048 x 2048 pixels)  
Resolution: 0.001 deg. For Omega & Theta  
0.003 deg. For Kappa  
0.005 deg. For Phi  
Scanning Speed Range: 0.005-3.0 deg./sec.  
SPELLMAN DF6ON3 X-Ray Generator 4.2KW  
Video Microscope for color images of the crystal  
CrysAlis® software package

---

26) **Nikon confocal microscope**

- Nikon Laser scanning confocal microscope  
- Microscope having live cell facility  
- Motorized inverted microscope  
- Resonant scanner (for high speed imaging)  
  XY motorized stage (multi point time lapse imaging)  
- Motorized fluorescence attachment  
- PC controlled 130W Hg fiber illuminator  
- CO2 incubation system with controlled Temp and humidity control  
- Software for offline analysis