Parul® University
NAAC GRADE A++

Supported By
Industries Commissionerate
Government of Gujarat

MICRO - NANO

RESEARCH & DEVELOPMENT CENTER



micronanornd.paruluniversity.ac.in

About Parul University

Situated at the heart of the cultural capital of Gujarat, Vadodara, Parul University is a testament to the fusion of rich cultural heritage history and the contemporary 21st century. Since its inception in 1993 to its recognition as an University in 2015, Parul University has emerged as one of the largest and leading academic institutions. The university is a rich blend of 21 faculties and 38 institutes offering a wide range of diploma, graduate, and postgraduate degree programs in various academic disciplines.

NAAC GRADE A++

ACCREDITED University

QS-I Gauge **TOP 50 NIRF RANKING**

4 Star Rating from MoE, GoI



The PU Advantage

150+
Acres Campus

50,000
Students

3200+
International Students

180+
Startups Incubated

21,000+
In-campus Residency

150 National
Awards & Rankings

2500+
Faculties

160+ Professors from
IITs, NITs, IISc, NIDs, NIFTs

100+ Foreign
Partnerships

About Parul University
Micro-Nano Research & Development Centre

The Micro Nano Research and Development Centre at Parul University, Vadodara, was established in 2024 under the auspices of the Industries Commissionerate, Government of Gujarat. This centre was funded through the Scheme for Assistance for Research & Development Activities, under Gujarat Industrial Policy 2020. It is set to become a leading R&D Centre for cutting-edge research and innovation in micro and nano technologies.

Key Features

Advanced Fabrication and Characterization Facilities :
The Advanced manufacturing and Characterization Facilities are equipped with state-of-the-art techniques and technology to facilitate advanced research in the fields of micro and nano sciences, as well as micro and nanoscale device manufacturing and analysis.

Multidisciplinary Research Capabilities :
Interdisciplinary teams and research projects in nanomaterials, Nanoelectronics, MEMS, and biomedical nanotechnology, comprising collaborative initiatives that span academia, industry, and government.

Educational and Training Programs :
Postgraduate courses, seminars, workshops, and practical training aiming at cultivating proficient workforce in the field of micro and nanotechnology.



The “Micro Nano Research and Development Centre” aspires to be a premier center of innovation and excellence in micro and nanotechnology. This will be achieved by conducting cutting-edge research, fostering a culture of scientific and technological innovation, and developing next-generation materials, devices, and systems that address critical global challenges, improve the quality of life, and bridge the gap between fundamental research and practical implementation. Additionally, the center will train the next generation of scientists, engineers, and entrepreneurs.



VISION

The "Micro Nano Research and Development Centre" is dedicated to the advancement of micro and nano technology by means of innovative approaches, rigorous research, and interdisciplinary collaboration. The objective is to create innovative materials, devices, and systems that address global challenges, improve societal well-being, stimulate economic development, and sustainable and technologically advanced future.

MISSION



Target Research Sectors



- Material Science
- Pharmaceutical Science
- Biomedical and Health Science
- Engineering
- Semiconductor Technology
- Energy

Research Excellence at Parul University

20 Cr+
Research Grants

320+
Ph. D Research Guides

6000+
Scientific Research Paper Published

185+
Patents Filed

60+
Copyrights Filed & Granted

135+
Patents Published

✦ Our Equipments ✦

Scanning Electron Microscope (SEM) with EDS

Model Name
SU3800 Hi-SEM with EDS and Sputter Coater

Company Name
Hitachi High-Tech India Pvt. Ltd.

About :

The Hitachi SU3800 SEM performs high-resolution characterization and analysis, yielding precise nanoscale surface information. It is equipped with advanced optics and detection systems, including SE, BSE, UVD, and STEM detectors. The SEM provides comprehensive information about specimen surface morphology, with an EDS system for elemental composition analysis.

Salient Features:

- Five-axis motorized stage with a maximum specimen size of 200mm in diameter.
- High resolution: 3.0 nm at 30kV (High Vacuum Mode) for SE, and 4.0 nm at 30kV (Low Vacuum Mode) for BSE.
- Unique Ultra Variable Pressure Detector (UVD II) for SE imaging and CL imaging.
- Oxford Xplore EDS system for live elemental mapping.
- Gold sputter coating unit for preparing conducting layers on non-conducting samples.

Applications:

- Materials research, nanotechnology, ceramics, composites, polymeric materials, geology, dental materials, biological and soft materials.

Discover the Nanoscale World with SU3800 SEM. High-Resolution Imaging and ElementalAnalysis at Your Fingertips.



CNC MICRO Machine tool

Model Name : Hyper-15 Table Top Type Integrated Multi-Process CNC Machine Tool

Company Name
Sinergy nano systems

About :

The Hyper-15 Micro-CNC machine tool boasts multi-process capabilities, including Micro Turning, Micro Milling, Micro Drilling, Micro EDM Drilling, and Micro Scanning EDM (EDM Milling). It supports research in both traditional and non-traditional micromachining, targeting applications in metal industries and mechanical work on metals.

Key Features :

- Versatile for rapid prototyping, precision engineering, and small-scale production.
- High precision and efficiency in machining intricate components.

Included Tools :

- End Mill Cutters (Carbide Material): 0.2mm, 0.3mm, 0.4mm, 0.5mm
- Drill Bits (HSS Carbide Material): 0.4mm, 0.5mm
- Electrodes (Copper, Brass, Tungsten Carbide): 0.4mm, 0.5mm, 100mm length

Experience the power of precision and innovation with the Hyper-15 Tabletop CNC Machine. Transform ideas into reality—start machining today!



RF & DC Magnetron Sputtering with Thermal Evaporation System

Model Name : Auto 500 | **Company Name** : HHV Advance Technologies Pvt. Ltd.

About :

The Auto 500 system combines RF and DC magnetron sputtering with thermal evaporation capabilities, enabling the growth or deposition of uniform thin films on substrates. It supports various deposition parameters, such as substrate temperature, environment, deposition rate, power, and substrate-to-target distance.

Salient Features :

- Versatile front-loading coating system with a box chamber.
- Equipped with RF (300W, 13.56 MHz) and DC (1KW) magnetron sources for diverse thin film applications.
- Adjustable substrate temperature from room temperature to 500°C.
- Thin film deposition under Argon and Nitrogen environments.

Applications :

- Anti-reflective coatings, semiconductor industries, photonics research, compound semiconductors, solar cells, and nanotechnology.

Achieve Unmatched Thin Film Quality with Auto 500. Elevate Your Research with Precision Deposition Techniques.



Scanning Probe Microscope (AFM)

Model Name : Core AFM

Company Name : NANOSURF AG Switzerland

About :

- Atomic Force Microscopy (AFM) is a powerful imaging technique used in nanotechnology and materials science. The Core AFM scans a tiny probe over a sample's surface, measuring the forces between the probe and the sample to observe high-resolution topography images.

Salient Features :

- Various operating modes: Contact mode, Tapping mode, Magnetic force microscopy (MFM), Electrical force microscopy (EFM), Force modulation, Standard and Advanced lithography, and spectroscopy.
- Capable of topography image measurement of solid and biological samples.
- Mountain SPIP commercial license image analysis software for visualization and analysis of AFM images.

Applications :

- Surface topography, material properties at the nanoscale, biological samples, surface roughness, electrical property mapping.

Explore the Nanoscale Universe with Core AFM. Unmatched Precision in Surface Imaging and Analysis.



Piezo-based Multicomponent Dynamometer

Model Name : Piezo-based Dynamometer (MLB-PML- PZ500)

Company Name : Medliab Enterprise

About :

The Piezo-based Dynamometer represents a breakthrough in force measurement technology, utilizing piezoelectric sensors to convert mechanical stress into electrical signals with remarkable accuracy and sensitivity. The MLB-PML- PZ500 is ideal for various applications from biomedical research to industrial quality control.

Salient Features:

- Capacity: 5 kN, Radial and Thrust measuring range: 0 ± 5000 N.
- Sensitivity: 0.1 N, Accuracy: ± 0.5%, Traceable to National Physical Laboratory.
- MT & Milling tool software for digital and graphical display of forces, data recording, printing, and transfer to MS Excel.

Applications:

- Precise force measurement capabilities driving advancements across various fields.

Measure with Unparalleled Accuracy with Piezo-based Dynamometer. Precision Force Measurement for Advanced Research.



X-Ray Diffractometer (XRD)

Model Name : D6 PHASER

Company Name : Bruker India Scientific Pvt. Ltd.

About :

The D6 PHASER X-ray diffractometer is an adaptable instrument designed for analyzing powders, thin films, epitaxial layers, ceramics, and other materials through X-ray diffraction. This technique involves directing main X-rays at the sample substance, where its wave nature causes diffraction at specific angles, providing information on the crystal structure.

Salient Features:

- XRD measurement with a 1.2KW X-ray tube source.
- Accurate XRD pattern measurement with ±0.01° precision.
- Various specimen holders for user-defined applications in pharmaceuticals, materials science, life science, and engineering.
- Vacuum chuck for tiny thin film samples and wafer testing.

X-Ray Reflectometry (XRR):

- Measures the thickness, density, and roughness of thin films.
- Provides high-resolution data for thin film analysis.

Applications:

- Material research, pharmaceuticals, energy sector, semiconductor industries, and crystallographic research.

Unlock the Secrets of Crystalline Structures with D6 PHASER. Precision Analysis for Advanced Material Research.



Pin on Disc Wear Testing Machine

Model Name : NTS-R&D Version-03 | **Company Name** : NOVUS TRIBO SOLUTIONS

About :

Novus Tribo Solutions & Pin-on-Disc Wear Testing Machine is a precise tool that replicates sliding wear conditions between two materials. It is commonly used to assess the wear resistance, friction behavior, and durability of different materials and composites in research and development, quality control, and failure analysis.ave nature causes diffraction at specific angles, providing information on the crystal structure.

Salient Features:

- Accurate adjustment of the test duration, normal load, and sliding speed.
- Precise measurement of friction force and wear.
- Specimen pin heating is also possible up to 300˚C
- Compatibility with a wide range of materials and test specimens.
- User-friendly interface for easy operation and data analysis.
- Compliance with industry standards (e.g., ASTM G99)

Applications:

- Metals and Nonmetals, Composites, Polymers, Metal matrices, Coatings, Clutch material, Friction stir welding, Brake material, Biomaterials, Food grade materials, Aluminum composites, implants, prosthetics, Lubricants and additives, etc.

Accurately measure wear and friction for optimal material performance.



LCR Meter

Model Name : Zm2376 | **Company Name** : NF (Wayne Kerr) Made in Japan

About :

The ZM2376 LCR meter is a precision measurement tool designed to evaluate inductance (L), capacitance (C), resistance (R), and impedance (Z) across a wide frequency spectrum. This versatile instrument is ideal for both laboratory and industrial applications, providing highly accurate data for dielectric property analysis of solid materials.

Salient Features:

• Measures key parameters: Impedance (|Z|), Admittance (|Y|), Inductance (L), Capacitance (C), Resistance (R), and Conductance (G).
• Secondary parameters: Q-factor, Dissipation Factor (D), Phase Angle (**θ**), Reactance (X), Susceptance (B), Series Resistance (Rs), Parallel Resistance (Rp), Parallel Conductance (Gp), Inductance (Lp), and Rdc.
• High-temperature range: From room temperature up to 400°C, suitable for solid material testing in extreme conditions, with a furnace equipped with gold-plated electrodes.
• Broad frequency range: 1 millihertz to 5 Megahertz, with frequency sweep functionality for comprehensive analysis.

Applications:

• Solid Material Characterization: In-depth testing of dielectric properties for materials such as ceramics, polymers, and composites.
• Electronic Component Testing: Precision validation of capacitors, inductors, and resistors.
• Industrial Material Analysis: Ideal for material testing in environments requiring extensive temperature and frequency range adaptability, from low to high-frequency applications.



Precision testing with gold-plated electrodes for extreme accuracy across a broad temperature and frequency range.

Simultaneous Thermal Analyzer (STA)

Model Name : NEXTA STA 200 **Supplied by:** Inkarp Instruments Pvt. Ltd., Ahmedabad

Manufactured by: Hitachi High-Tech Analytical Science, Japan

About :

The Hitachi NEXTA STA 200 is a simultaneous thermal analysis system that combines Thermogravimetric Analysis (TGA) and Differential Thermal Analysis (DTA), with DSC conversion capability, in a single instrument. It is used to study weight changes and thermal events of materials as a function of temperature and time. The system is suitable for polymers, composites, nanomaterials, metals, ceramics, and inorganic materials under controlled atmospheres. These measurements are important for materials development, process optimization, quality control, and performance evaluation.

Salient Features:

- Thermostatted ultra-microbalance
- Temperature range: Room temperature to 1100 °C
- Heating rate: 0.01 °C/min to 100 °C/min.
- Balance design: Horizontal dual-beam design
- Balance housing: Isolated from the furnace and sample chamber
- Forced air cooling (1000 °C to 50 °C within ~20 minutes)
- TGA Balance resolution: 0.05 µg
- Both solid and liquid samples can be tested.
- Built-in mass flow controllers for two gases.
- DTA / DSC sensitivity: 0.06 µV
- Software-controlled gas switching

Applications:

- Thermal decomposition and weight loss studies of polymers and composites
- Analysis of thermal stability and degradation behavior
- Oxidation and reduction studies under controlled atmospheres
- Study of phase transitions and reactions with simultaneous mass change
- Quality control and comparison of material thermal behavior

Simultaneous Measurement of Thermal Events and Mass Changes



Differential Scanning Calorimeter (DSC)

Model Name : NEXTA DSC 200 **Supplied by:** Inkarp Instruments Pvt. Ltd., Ahmedabad

Manufactured by: Hitachi High-Tech Analytical Science, Japan

About :

The Hitachi NEXTA DSC 200 is a Differential Scanning Calorimeter used for reliable thermal characterization of a wide range of materials, including polymers, composites, nanoparticles, and nanomaterials. The instrument helps in understanding thermal behaviour as a function of temperature and time. It enables accurate measurement of glass transition, melting, crystallization, curing reactions, and specific heat under controlled atmospheres. These measurements are important for materials development, process optimization, quality control, and performance evaluation.

Salient Features:

- DSC type: High-performance heat flux type
- Temperature range: -90 °C to 500 °C
- Three-layer furnace design to minimize external disturbances.
- Corrosion-resistant gold-coated DSC thermopile sensor.
- Heating / cooling rate: 0.01 °C/min to 100 °C/min
- Temperature accuracy: ±0.05 °C
- DSC sensitivity: 0.2 µW
- Both solid and liquid samples can be tested.
- Rapid sample cooling for efficient experimentation.

Applications:

Determination of glass transition, melting, and crystallization behavior of polymers and composites.
Thermal analysis of nanoparticles, nanocomposites, and advanced functional materials.
Measurement of specific heat and phase transitions under controlled atmospheres
Comparison of material quality, batch consistency, and thermal stability for research and quality control

Reliable Thermal Analysis for Materials Research.



Fourier Transform Infrared (FTIR) Spectroscopy

Model Name : FTIR-4X **Supplied by:** Anatek Services Pvt. Ltd., Mumbai

Manufactured by: JASCO International Co. Ltd., Japan

About :

The JASCO FTIR-4X is a high-performance Fourier Transform Infrared spectrometer designed for precise qualitative and quantitative characterization of molecular structures across a wide spectral range. Engineered with a superior signal-to-noise ratio of 35000:1 and integrated with a temperature-controlled DLATGS detector, the system ensures exceptional analytical stability and reproducibility. The FTIR-4X is ideally suited for routine and research-grade analysis of powders, thin films, polymers, ceramics, liquids, and other solid-state materials (excluding gases). Its robust optical design and sealed interferometer architecture provide long-term operational reliability in demanding laboratory environments.

Salient Features:

- Broad spectral coverage: 7800–350 cm^{-1}
- High spectral resolution: Selectable resolutions of 0.4, 0.5, 1, 2, 4, 8, and 16 cm^{-1}
- High sensitivity: 35000:1 signal-to-noise ratio
- Advanced measurement modes: Absorbance (Abs), Transmittance (%T), and Reflectance (%R)
- ATR capability: Equipped with ATR PRO 4X single-reflection accessory
- Wide-band sampling: Diamond crystal kit (PKS-D1F) for robust, universal sample analysis
- Detection system: Standard DLATGS detector with Peltier temperature stabilization
- Optical components: Ge-coated KBr beamsplitter for optimized IR throughput
- Durable design: Sealed interferometer with KRS-5 window to prevent moisture and particulate contamination

Applications: Materials Research, Nanotechnology, Pharmaceutical & biomedical materials, Environmental testing, and Academic research.

High-precision spectral insights for advanced materials, nanotechnology, and functional characterization



UV-VIS-NIR Spectroscopy with IRS

Model Name : V-770ST UV/VIS /NIR Spectrophotometer

Company Name : JASCO International Co. Ltd., Japan

About :

The V-770 Double Beam UV-Visible/NIR Spectrophotometer (JASCO) is a high-performance analytical instrument designed for precise and stable measurements across a wide spectral range from UV to near-infrared (≈190–2700 nm). It features a single-monochromator, double-beam optical system that ensures excellent baseline stability, low stray light, and high signal-to-noise ratio, supported by a PMT detector for UV-Vis and a Peltier-cooled PbS detector for NIR. The instrument offers flexible bandwidth selection, fast scanning speeds, and seamless control through Spectra Manager™ software, making it suitable for both routine and advanced analyses. Applications include optical characterization of semiconductors and nanomaterials, band-gap estimation, thin-film and coating analysis, diffuse and specular reflectance studies, quantitative analysis of solutions, and material research in physics, chemistry, materials science, pharmaceuticals and environmental studies.

Salient Features:

- Wavelength Range: 190 – 2700 nm
- Spectral Bandwidth: Variable across multiple settings for UV-vis and NIR
- Scanning Speed: Up to ~4000 nm/min (~8000 nm/min preview)
- Detectors: PMT (UV-Vis), Peltier-cooled PbS (NIR)
- Optical System: Single monochromator, fully symmetrical double beam
- Advanced Software Control: JASCO's Spectra Manager™ software
- Flexible Measurement Modes: Supports standard modes such as absorbance, transmittance and reflectance (specular and diffuse), making it suitable for liquids, solids, powders and films
- Low Stray Light & Noise: Excellent stray light performance and low baseline noise ensure high measurement accuracy.
- High-Performance Scanning: Variable spectral bandwidth settings allow flexibility from narrow to broader bandwidths.

Applications: Materials Research, Nanotechnology, Pharmaceutical & biomedical materials, Environmental testing, and Academic research.



Spectral analysis enabling precise characterization of materials, films, solutions, and functional systems

Computerized Bottom Pouring Type Stir Casting Machine

Model Name : 2Kg Model

Company Name : SwamEquip, Chennai

About :

The bottom-pouring type stir-casting machine allows user to make Metal Matrix Composite (MMC) or Alloys with the based metal as Aluminium (Al). The bottom pouring facility allows the user to transfer the molten metal into the mold with a click of a button thereby nullifying the manual efforts and errors involved in this operation. The computerized model of this machine is the advanced version of this machine in which all the parameters of this machine can be viewed, and controlled, using a mini-computer.

Salient Features:

- Variable speed: 300 to 1200 RPM
- Maximum furnace temperature: 800 °C
- Pre-heater for Mould: Maximum attainable temperature is 450 °C
- Powder Pre-heater for reinforcement: Maximum attainable temperature is 200 °C
- This facility allows the user to lift the stirrer UP/DOWN while stirring automatically
- Bottom Pouring Valve for easy and safe pouring of the melt

Applications:

Development of Metal Matrix Composite
(MMC) or Alloy

Your Gateway to High-Precision MMC Manufacturing.



Compression Molding Machine

Model Name : 50-Ton ASTM Specimen Molding Model

Company Name : Hexa Plast, India

About :

The automatic compression molding machine is designed for preparing ASTM-standard metal and polymer composite test specimens. It supports to prepare the specimen using molding for tensile (ASTM E8), flexural (ASTM D790), and compression (ASTM E9) testing. The system provides automatic control of temperature up to 110 °C, pressure up to 50Tons, and cycle timing, while mold handling and pressing operations are manual or semi-automatic.

Key Features :

Capacity: 50 Tons | **Temperature range:** RT - 110 °C | **Heating System:** Electric heating elements

Automatic Controls: Temperature, pressure, cycle time

Pressing System: Build–hold–release operation with automatic pressure regulation

Mold Operation:

Material is filled into the bottom mold cavity

Lower mold section moves upward to compress the material

Compatible ASTM Metal/Composite Standards

ASTM E8 – Tensile rod specimens | ASTM D790 – Flexural bars | ASTM E9 – Compression cylindrical specimens

Applications:

- Preparation of metal and polymer composite test specimens
- Fabrication of tensile, flexural, and compression ASTM-standard samples
- Suitable for research laboratories, testing centers, and composite material development

Controlled Pressure and Temperature for Reliable Mechanical Sample Preparation.



Dynamic Signal Analyzer

Model Name : Coco-80X | **Company Name :** Crystal Instruments

About :

The CoCo-80X is a new generation of handheld data recorder, dynamic signal analyzer and vibration data collector from Crystal Instruments. Building on the success of the original CoCo-80, the new CoCo-80X boasts improved speed, a bigger screen, and more connection options. A significantly more powerful processor frees DSP resources for faster, more reliable, and more complex processing in real-time.

Salient Features :

Inputs: 2, 4, 6, 8 channels

Up to 8 BNC connectors, built-in IEPE current source, single-ended or differential, AC, DC coupling, 150 dBFS dynamic range, dual 24-bit A/D converters, input range ±20 Volts

Output: 1 LEMO connector, 100 dB dynamic range, 24-bit A/D converter

Tacho: 1 LEMO connector: Tachometer Type 1 and 2 share one LEMO connector and can be selected by the software Interface

Detectors: 100 Base-T Ethernet, Wi-Fi, GPS, Mini-USB 2.0, SD Card, Audio input and output, CA N-Bus

Maximum Sampling Rate: 102.4 kHz simultaneously for all inputs

Typical Real-time Analysis Functions: Math (+,-,*, /), integration, differentiation, FFT, averaging, windowing, auto power spectra, cross spectra, FRF, coherence, real-time filters, RMS, octave, order tracking, swept sine, limiting, alarm/abort and more.

Vibration Data Collection Functions: RMS, true-RMS, overall-RMS, waveforms, spectrum, demodulated spectrum, trending and alarm, 2 plane balancing. Measure acceleration, velocity, displacement & tachometer

Applications

Academic research involving vibration analysis, structural dynamics, modal testing, and experimental validation of mechanical and electromechanical systems.



Precision Vibration Analysis and Real-Time Signal Insight for Advanced Academic Research.

Our Workshops & Training Programs

The center conducts structured equipment-centric workshops designed for rapid skill acquisition and practical competency, offered in 1-day, 2-day, and 3-day formats. These programs are systematically organized to integrate live demonstrations, concept-driven learning, and intensive hands-on training on advanced micro- and nano-scale characterization, fabrication, and processing instruments. Each workshop is delivered by domain experts with a strong emphasis on real-world operating procedures, data interpretation, and application-oriented usage, ensuring participants gain immediately deployable technical capability aligned with academic, research, and industrial requirements.

Glimpses









Our Industrial Clients

- Seashore Nanotech
- Colud Nectar Pvt. Ltd
- Matplat
- Toto India Industries Pvt. Ltd
- Nomisma Healthcare Pvt. Ltd
- Gujarat Metal Cast
- Porelab Scientific Pvt. Ltd
- Aamyo Laboratories Pvt. Ltd
- Burakia Industrial Ltd
- Sidheswara Drugs
- Shreeneel Chemical
- BDR Pharma
- BDR Lifescience
- Zerofold Internet Pvt. Ltd
- Accuprec Research Labs Pvt. Ltd.
- PCBL Chemical
- Met Heat Engineers Pvt. Ltd
- Sudeep Advanced Materials PVT LTD



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