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PDEU PANDIT DEENDAYAL ENERGY UNIVERSITY

Formerly Pandit Deendayal Petroleum University (PDPU)

CENTRE OF EXCELLENCE STATUS BY GOVT. OF GUJARAT

SCHOOL OF ENERGY TECHNOLOGY

Department of Chemistry

Name of Laboratory: Research Laboratory

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NAME OF EQUIPMENT :
Rigaku MiniFlex X-Ray Diffraction

TECHNICAL SPECIFICATIONS :

- It is the sixth-generation MiniFlex system designed for fast and accurate X-ray diffraction measurements.
- The instrument is used for qualitative and quantitative analysis of polycrystalline materials.
- It helps in identifying unknown phases by comparing diffraction patterns with databases.
- The system uses an X-ray tube with a maximum power of 600 W (40 kV, 15 mA).
- It includes high-speed detectors such as D/teX Ultra2 (1D silicon strip detector) and XSPA-200 ER (2D hybrid pixel array detector).
- The detector allows data collection in 0D, 1D, and 2D modes for different analytical needs.
- The instrument is controlled by SmartLab Studio II software for measurement, analysis, and reporting.
- It can perform phase identification, crystallinity analysis, lattice parameter refinement, crystallite size determination, and Rietveld analysis.
- MiniFlex is widely used in materials science, chemistry, geology, pharmaceuticals, petrochemicals, and quality control laboratories.

NAME OF EQUIPMENT :
Nuclear Magnetic Resonance Facility (400 MHz) Make- JEOL

TECHNICAL SPECIFICATIONS :

- Magnet Strength: 9.4 Tesla (400 MHz for proton NMR)
- Probe: Compatible with various NMR active nuclei like (^{1}H, ^{13}C, ^{19}F, ^{15}N and etc. Also compatible with Proton and fluorine decoupling NMR spectra.
- Temperature Control: Precise temperature control system for cryogenic to elevated temperatures from -150 ^{o}C to 100 ^{o}C Temp.
- Pulse Sequences: Supports standard 1D and 2D NMR experiments
- Data Acquisition System: High-speed digitization and processing for rapid acquisition of spectra
- Software: Advanced data processing and analysis software packages for spectral processing and structure elucidation
- Automation: Automation capabilities for sample handling and parameter optimization
- Sample Handling: Sample changers and automation systems for high-throughput data acquisition

NAME OF EQUIPMENT :
Gas Chromatography

TECHNICAL SPECIFICATIONS :

- Type: Capillary Gas Chromatograph (Energy-saving, compact)
- Column Oven Temperature: Room temp + 10°C → 400°C
- Injector: Split / Spitless (SPL)
- Detector: Flame Ionization Detector (FID)
- Detection Limit: ~ 2 pgC/s (dodecane)
- Gas Flow Control: Electronic (AFC/APC) – precise pressure & flow control
- Display: 30 × 16-character screen (chromatogram display)
- Column Compatibility: Capillary columns (max depth ~9 cm)
- Energy Efficiency:~30% lower power consumption than older models
- Key Feature: High sensitivity + compact design + excellent reproducibility

NAME OF EQUIPMENT:
Diffuse Reflectance Spectroscopy

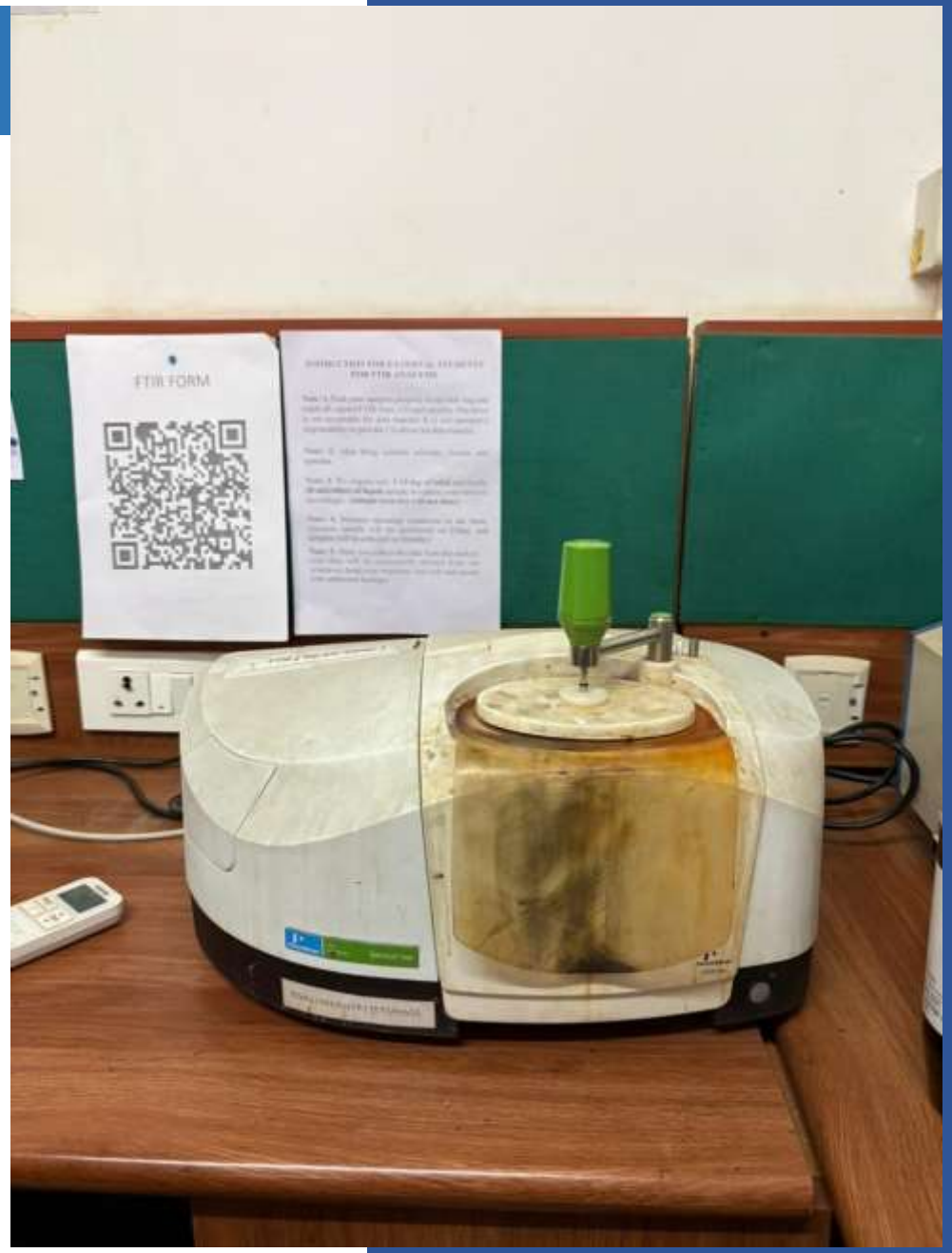
TECHNICAL SPECIFICATIONS :

- The PerkinElmer LAMBDA 365+ UV/Vis Spectrophotometer is a double-beam spectrometer designed for accurate ultraviolet and visible spectral analysis. It operates in the wavelength range of 190–1100 nm, enabling measurements in both UV and visible regions. The instrument is used for qualitative and quantitative analysis of polycrystalline materials.
- The instrument uses a Czerny–Turner monochromator with holographic grating, along with a deuterium lamp (UV region) and tungsten–halogen lamp (visible region) as light sources. A silicon photodiode detector is used for precise detection of transmitted or reflected light.
- For Diffuse Reflectance Spectroscopy (DRS), the system can be equipped with an integrating sphere accessory, which allows analysis of powdered and solid samples by collecting scattered light.
- The spectrometer is controlled using UV WinLab software for spectral acquisition, data processing, and analysis. It is widely used for optical band gap determination, semiconductor studies, pigment analysis, and materials characterization.

NAME OF EQUIPMENT :
FTIR: Fourier Transform Infrared Spectroscopy

TECHNICAL SPECIFICATIONS :

- Instrument: Perkin Elmer Spectrum Two FTIR Spectrophotometer for qualitative and quantitative infrared analysis
- Measurement modes: Transmission and Attenuated Total
- Reflectance (ATR)ATR crystal: Diamond crystal for robust analysis of
- Solids and liquids Spectral range: 2.5 µm to 25 µm (4000–400 cm^{-1} wavenumber range)
- Application: Material identification, functional group analysis, and quality control



NAME OF EQUIPMENT :
Flash Chromatography (Smart Flash AKROS)

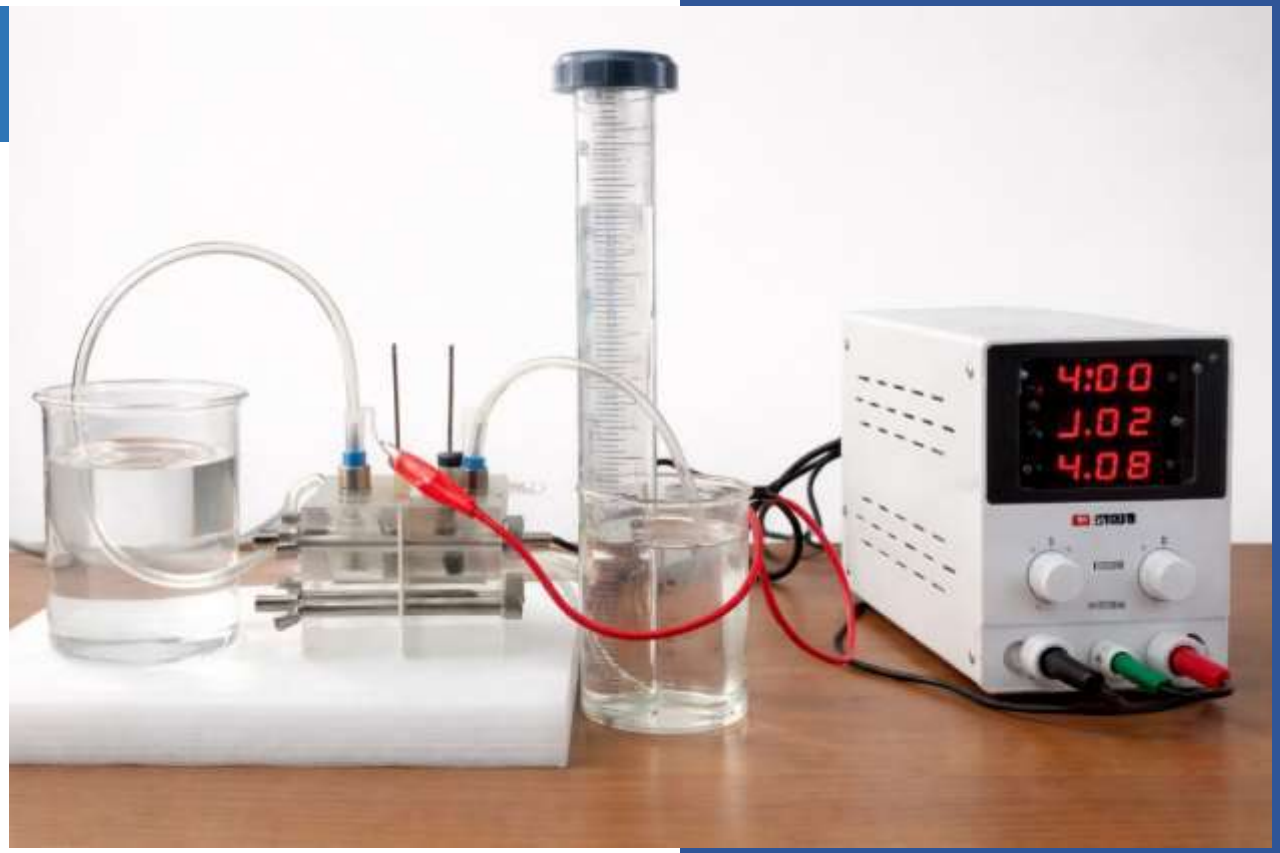
TECHNICAL SPECIFICATIONS :

- Automated purification system
- Works for sample sizes from mg to gram scale
- Predicts compound elution position and loading capacity
- TLC image reader with flash chromatography
- Displays TLC image along with chromatogram peaks
- high-resolution separations using UV detection
- Automatically develops optimised purification methods

NAME OF EQUIPMENT :
Water Electrolyzer for Green Hydrogen Production

TECHNICAL SPECIFICATIONS

- Transparent electrolytic reactor
- Specification:
- Anode area – 3 cm2
- Cathode area – 3 cm2
- Total electrolyte volume – 12 mL,
- Gasket-silicon-based
- Membrane –Anion Exchange Membrane

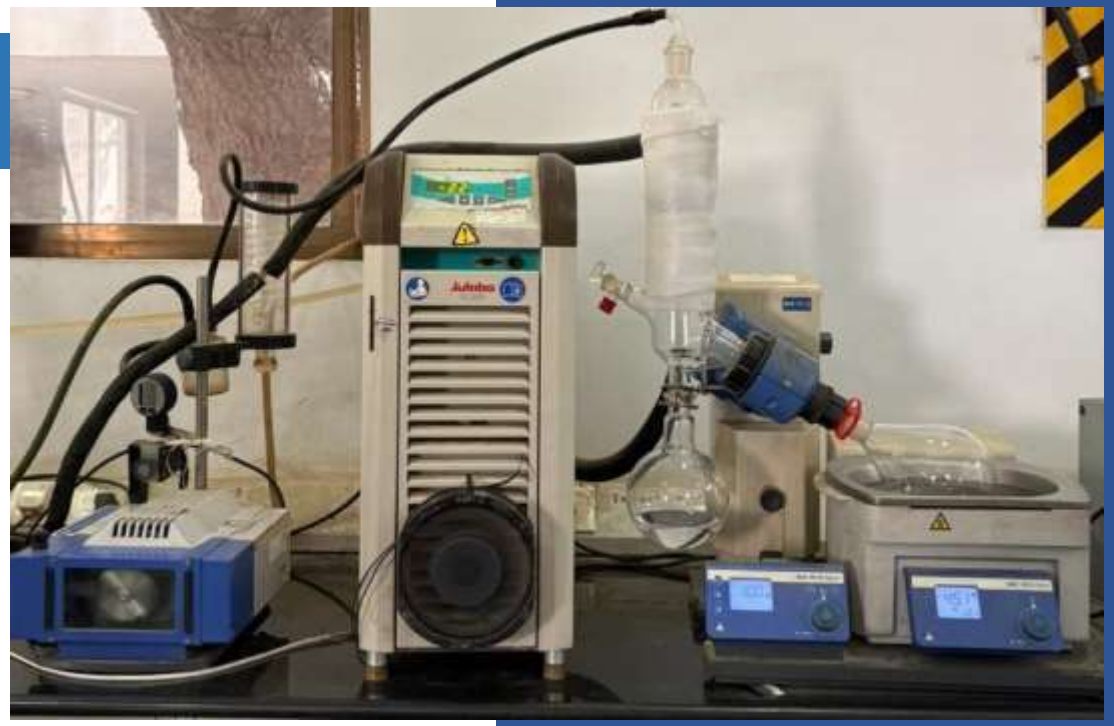


NAME OF EQUIPMENT :
Gas Sensing Measurement Unit

TECHNICAL SPECIFICATIONS:

- The gas sensing unit is used to evaluate the sensing performance of materials toward volatile organic compounds (VOCs).
- The system consists of a gas sensing chamber, digital source meter (Keithley, Model 2450), temperature controller with heater, and a computer for data acquisition.
- The digital source meter (KEITHLEY, Model No. 2450) provides precise sourcing and measurement of electrical parameters with specifications of 200 V, 1 A, and 20 W.
- The gas sensing chamber provides a controlled environment for exposure of sensing materials to analyte gases.
- The temperature controller with heater allows operation of the sensor up to 300–350 °C.
- The system is interfaced with a computer using Keithley software for real-time monitoring and recording of sensing response.
- The setup enables evaluation of sensor response, sensitivity, response time, and recovery time of gas sensing materials.

NAME OF EQUIPMENT :
Rotary evaporator



TECHNICAL SPECIFICATIONS

Rotation speed: 5–280 rpm

- **Lift:** Motorised, 140 mm stroke
- **Bath temp.:** RT to 180 °C
- **Heating power:** ~1300 W
- **Bath volume:** ~3–4 L
- **Flask capacity:** Up to 3 L
- **Condenser:** Vertical / coil (~1200–1500 cm^2)
- **Display:** Digital (TFT in advanced models)

Solvent removal: Rapid evaporation of solvents from reaction mixtures

Concentration: Concentrates solutions without decomposition

Solvent recovery: Recycles expensive or hazardous solvents

Purification: Removes volatile impurities after synthesis

Distillation: Performs low-pressure (vacuum) distillation

Heat-sensitive compounds: Safe evaporation at low temperature

Sample preparation: Used before analysis (HPLC, GC, etc.)

Extraction workup: Removes solvent after liquid–liquid extraction

NAME OF EQUIPMENT :
Vacuum Pump

TECHNICAL SPECIFICATIONS

- **Type:** Oil-lubricated
- **Stages:** Single stage
- **Flow rate:** ~20 – 100 L/min (lab models)
- **Ultimate vacuum:** up to 0.5–0.001 mbar (depending on stage)
- **Motor power:** 0.25 – 1 HP
- **Oil capacity:** ~200–500 ml
- **Speed:** ~1400–2800 rpm

- **Vacuum generation:** Creates low pressure for lab operations
- **Rotary evaporator:** Used with Rotary Evaporator for faster
- solvent evaporation
- **Distillation:** Enables vacuum (reduced pressure) distillation
- **Filtration:** Speeds up vacuum filtration processes
- **Drying:** Removes moisture in vacuum ovens/desiccators

NAME OF EQUIPMENT :
Photochemical Reactor

TECHNICAL SPECIFICATIONS :

- **System Type:** UV–Vis photochemical reactor with an enclosed chamber for controlled light-induced reactions.
- **Light Source:** Integrated UV–Visible lamp with an external controller for switching and operation.
- **Temperature Control:** Cold water circulating tank with digital display and adjustable temperature for maintaining stable reaction conditions.
- **Construction & Design:** Metal housing with UV-shielded enclosure, front door access, and reflective interior for uniform irradiation.
- **Applications:** Used in photocatalytic degradation studies, polymerization reactions, and advanced oxidation processes.

NAME OF EQUIPMENT :
Rotary Shaker

TECHNICAL SPECIFICATIONS :

Mini Rotary Shaker Brand and Model: REMI RS-12
Plus Speed: Variable speed up to 450
RPM Timer: Digital countdown timer up to 99 minutes

NAME OF EQUIPMENT :
High Temperature Hot Air Oven

TECHNICAL SPECIFICATIONS

- Temperature – RT to 250 C
- Temperature controller-microprocessor-based auto-tune PID temperature controller
- Internal size-300W * 300D * 300H MM

NAME OF EQUIPMENT :
Muffle furnace

TECHNICAL SPECIFICATIONS

- Temperature-1200 C
- Volume-12 L

NAME OF EQUIPMENT :
Tube Furnace

- **TECHNICAL SPECIFICATIONS**
- Horizontal single zone split
- Tube furnace customised
- Model temperature:-1200.C

NAME OF EQUIPMENT :
Hot Air Oven

- **TECHNICAL SPECIFICATIONS**
- Hot air oven size:-18x18x18inch
- Digital PID controller with air Circulation- fan
- Temperature- 180 ^{o}c

NAME OF EQUIPMENT :
Electrochemical Workstation

TECHNICAL SPECIFICATIONS

- Cyclic Voltammetry (CV) and Linear Sweep Voltammetry (LSV)
- Voltage Range: ±30V
- Potential Range: ±20 V
- Current Range ±6 A
- Scan Range- 10000 mv/sec
- Tafel Plot (TAFEL)-Linear Polarisation for Tafel graph plotting with automatic evaluation of corrosion current, tafel constant, anodic slope, cathodic slope

NAME OF EQUIPMENT :
Sonicator

TECHNICAL SPECIFICATIONS

- Ultrasonic cleaner capacity: -2 litres
- HEATING MANTLE CAPACITY:-250 to 500ML