INDIAN INSTITUTE OF TECHNOLOGY (INDIAN SCHOOL OF MINES) DHANBAD

OFFICE OF THE DEAN (RESEARCH AND DEVELOPMENT)

Departmental Research and Research Facilities

The Institute is having 18 Departments and 8 Research centers. Along with the regular teaching of undergraduate and postgraduate students, The Departments are actively involved in their respective core fields. Research centers of the Institute are cross-disciplinary engines of investigation in diverse areas of science and engineering.

- **Applied Chemistry**

   Major Research Areas:

   ❖ Nanomaterial, Nano Catalysis, Bio-organometallic catalysis, Organo catalysis, heterogeneous catalysis
   ❖ Coordination chemistry, catalysis, model complexes
   ❖ Polymer chemistry, Super capacitor, Electrochemistry, Corrosion science, Coordination compounds, Medicinal Chemistry
   ❖ Host-guest systems, bio-inorganic chemistry, bio-active molecules
   ❖ Polymeric hydrogels/Nano gels; Polymeric nanocomposites; Polymeric flocculants
   ❖ Syntheses of small molecule drugs for cancer treatment
   ❖ Molecular recognition, supramolecular chemistry, heterocyclic chemistry and organic synthesis.

Research Facilities:

1) *ELECTRON MICROSCOPY; Model: S-3400N, Make: Hitachi, Japan. To find out Surface morphology and chemical characterization.*

2) *SURFACE AREA & POROSITY METER ANALYZER; Model∶Nova 3200e, Make∶ Quantachrome, USA. Surface area and pore volume measurement.*

3) *PHOTOCHEMICAL REACTOR; Model∶RPR 100; Make∶Southern New England Ultraviolet Company, USA. Photochemical reactions.*

4) *BINARY GPC‑HPLC; Model∶2414; Make∶Waters (I) Pvt. Ltd; USA. Molecular weight determination of polymers and separation & purification of organic compounds.*

5) *GAS CHROMATOGRAPH WITH FIXED BED REACTOR Model∶GC2010; Make∶ CIC, India. Online analysis of gas phase reaction.*

6) *GAS CHROMATOGRAPHY; Model∶GC2011; Make∶CIC, India. Separating and analyzing of volatile gas & liquid samples.*

7) *UV‑VISIBLE SPECTROPHOTOMETER WITH FACILITY OF SOLID AS WELL AS LIQUID SAMPLE ANALYSIS; Model∶UV‑2450; Make∶Shimadzu, Japan. Used in analytical chemistry for the quantitative determination of different analytes.*

8) *FLUORESCENCE SPECTROPHOTOMETER; Model∶LS55; Make∶Perkin Elmer, USA. Fluorescence study of different organic samples.*

9) *POTENTIOSTAT; Model∶7800; Make∶Amel Instruments. Corrosion Analysis.*

10) *ELECTROCHEMICAL IMPEDANCE AND CORROSION ANALYSIS Model∶660 D; Make∶CH instruments; USA. Corrosion Analysis.*

11) *ELECTROCHEMICAL WORK STATION; Model∶660 C with 680 Amp Booster; Make∶CH instruments; USA. Corrosion & electrochemical analysis.*

12) *DIFFERENTIAL SCANNING CALORIMETRY; Model∶DSC7; Make∶Perkin Elmer, USA. Thermal characterization.*

13) *DRUG DISSOLUTION APPARATUS; Model‑DS 8000; Make‑LAB INDIA. For doing drug delivery studies.*

14) *NMR*

- **Applied Geology**

  Major Research Areas:

  - ❖ Coal Geology, Organic Petrology, Organic Geochemistry, CBM, Shale Gas, Source Rock Characterization, CO2 Sequestration and Coal Conversion
  - ❖ Ore Geology, Mining Geology, Mineral Exploration and environmental geochemistry
  - ❖ Micropaleontology, Paleoclimatology, Paleoceanography, Petroleum Geology
  - ❖ Climate Change, Image Processing & Spatial Analysis, Geostatistics & GIS,
  - ❖ Rock mechanics, Structural geology, slope stability analysis and numerical modeling.
  - ❖ Metallogeny of precious and basemetals, ore geochemistry, fluid inclusion studies
  - ❖ Geochemistry, Geotechnical engineering, enginnering geology, experimental geology
  - ❖ Hydrology and Remote Sensing, Metamorphic petrology

Research Facilities:

1) *X-RAY FLOURESCENCE (XRF). Geochemcial Analyses of Major and Trace Elements.*
2) *X-RAY DIFFRACTOMETER WITH TEXTURE GONIOMETER. Identification of Mineral Phases.*
3) *FRANKLIN DIRECT SHEAR TEST MACHINE. Engineering Properties of rocks.*
4) *LINKAM FLUID-INCLUSION (GEOTHERMOMETRY). Microscope Thermometry of ores.*
5) *POLARISING PETROLOGICAL MICROSCOPE (TRANSMITTED LIGHT). Mineralogical Studies of Rocks and Minerals.*
6) *PT-600 SARTORIUS ELECTRONIC TOP LOADING BALANCE. Weighing the samples.*
7) *RUSKA UNIVERSAL POROSIMETER. Engineering Properities of rocks and soils.*
8) *VIBRATING CUP MILL. Powdering the rock samples.*
9) *PHOTOAUTOMAT. Photomicrography of ores, rocks and minerals.*

10) *UNIVERSAL MODEL RESEARCH MICROSCOPE. Mineralogical Study.*

11) *STEREO BINOCULAR MICROSCOPES. For micropaleontological studies.*

12) *SEVERAL INTEL PENTIUM IV PC. Computation work.*

- **Applied Geophysics**

  Major Research Areas:

  ❖ Gravity & Magnetic Methods; Mineral Exploration; Geodynamics; Joint forward and inverse modeling

  ❖ Earthquake seismology, Seismic tomography, Receiver functions analysis, Surface wave dispersion analysis, focal mechanism solutions, geothermics, gravity and stress modeling

  ❖ Petrophysics, Geomechanics, Formation Evaluation, Well logging, Reservoir Geophysics, CBM and Shale Gas Exploration, Depp water Exploration, Gas Hydrate Exploration

  ❖ Nearsurface geophysics, passive seismic tomography for seismotectonic study and oil exploration, Exploration Geophysics, Subsurface Characterization, Bayesian Methods, Time Series Analysis in Geophysics

  ❖ Computational Geophysics, Quantitative and Qualitative Seismic Interpretation, Electrical, electromagnetic and magnetotelluric methods and geophysical inversion for shallow and crustal studies, Global optimization and geophysical exploration

  Research Facilities:

  1) *SEISMOLOGICAL OBSERVATORY.*
  2) *STUDENT'S GEOPHYSICAL SIGNAL PROCESSING LABORATORY with eight node parallel computation cluster facility.*
  3) *GPS-GeoXT receiver(Trimble make).*
  4) *GPS ProXR(Trimble make).*
  5) *GPS1200 (Leica make).*
  6) *24 Channel StrataVisor NZ Seismic Unit.*
  7) *12 Channel Seismic Unit, Seismic Source : Accelerated Weight Drop.*
  8) *MT Unit, TDIP, FDEM, VLF.*
  9) *Worden Gravimeters (Master & Prospector).*
  10) *ISM Gravity Base and Bench Mark facility.*

11) *Triaxial Digital Short-period seismic system with analog back-up in ISM Seismological Observatory.*

12) *Proton Precession Magnetometer, Flux Gate Magnetometer, Magnetic Susceptibility meter.*

13) *Conductivity meter, DC Resistivity Meter.*

14) *Standard Proton Gradiometer (Model No. GSM-19TG;V7.0)*

- **Applied Mathematics**

  Major Research Areas:

  ❖ Computational fluid dynamics, Elastodynamics, Wave Propagation Aspects, Crack Propagation

  ❖ Pseudo-Differential Operators, Wavelets, Distribution Theory, Mathematical Programming, Generalized Convexity, Vector Optimization, Variational Inequality

  ❖ Celestial mechanics & dynamcal astronomy, High Performance Computing(HPC), Optimization Techniques, Graph theory and Graph algorithms

  ❖ Sample surveys, Statistics; Estimation Techniques and its Applications, Reliability Estimation, Statistical Inference

  ❖ Fluid dynamics, Hydrodynamics/Solute Transport Modeling/Groundwater Contamination

  ❖ Number Theory and Algebraic Coding Theory, Boundary value problems, water waves and wave-structure interaction

  ❖ Differential equations, mathematical modeling, chaotic dynamics and dynamical system theory

  ❖ Elastodynamics (seismic wave propagation), Theoretical seismology and wave propagation aspects, Topology, category theory and fuzzy automata theory

Research Facilities:

1) *Two computer labs having 60 thin clients and 10 desktops connected with LAN*
2) *Three servers (Two Red Hat LINUX based and one WINDOWS based)*
3) *MATHEMATICA, thirty-one users network licenses*
4) *SPSS Software*
5) *One Digital Electronics Lab for 10 users(five setups)*

- **Applied Physics**

  Major Research Areas:

  - ❖ Laser based interferometry, Experimental micro and nanoscience
  - ❖ String theory, Atomic and molecular physics; molecular spectroscopy
  - ❖ Luminescence Studies, Material Science, Defect Solid State Studies
  - ❖ Photoluminescence, raman spectroscopy, Nanoscience & quantum electronics
  - ❖ Material science, Condensed matter theory, Semiconductor devices-solar cells, TB-LMTO software
  - ❖ Plasmonics and photonic devices, Polymeric Nano Hybrid B/T Materials for Energy Storage
  - ❖ Nanoclusters, Hydrogen Storage, Organic Semiconductors & Photovoltaics, Quantum Chemistry, Biophysics
  - ❖ Atomic & molecular physics, laser physics, phosphors, nanophotonics, Fiber sensors and Design and Characterization of Photonic Crystal Fiber.

Research Facilities:

1) *GENERAL LABORATORY - It has latest laboratory equipments for all courses such as Michelson Interferometer, ESR spectrometer, Kerr Effect, Zeeman effect, Hall effect, Multivibrators, Optical fibre based experiments, etc. In addition, it has a dark room for conducting optics based experiments.*
2) *LASER LABORATORY - It has one vibration free holographic table, Two He-Ne Lasers (each of 10 mW) and Holographic Accessories.*
3) *LUMINESCENCE LABORATORY - PC based Thermoluminescence Analyser system for recording and analyzing thermoluminescence glow curves, FTIR spectrophotometer, High temperature furnace, etc. -*
4) *SOLID STATE LABORATORY – PC based Thermoluminescence Analyser system for recording and analyzing thermoluminescence glow curves.Instruments for Hall effect, Four-Probe method of energy band gap studies, dielectric studies etc.*
5) *X-RAY LAORATORY – Radon House X-ray Generator and x-ray accessories.*
6) *DIELECTRIC LABORATORY – Hioki LCR meter, High temperature furnace, etc.*
7) *BIOMEDICAL LABORATORY - CCD camera, Bread board, IR viewer and card, Interferometer Flats, Hot and cold mirrors, etc*

8) *THIN FILM LABORATORY - Two thin film labs with latest equipment for synthesis and characterization of thin films, UV-VIS spectrophotometer, Langmuir-Blodgett film deposition apparatus, spin coater, etc.*

9) *SPECTROSCOPY LABORATORY – Constant deviation Spectrograph, Quartz Spectrograph, Ultrasonic Interferometer etc.*

10) *PHOTONICS LABORATORY – Finite element method software, Optical fibers, Power meter, LED source, Er doped Fiber, Fiber Bragg grating, etc.*

- **Chemical Engineering**

Major Research Areas:

- ❖ Carbon capture, gas separation, clean coal technology, modeling and simulation
- ❖ Nanotechnology, Surface Science, Interfacial Science, Nanotribology, Coatings
- ❖ Nano-structured materials, Artificial Photosynthesis, Solar energy, Heterogeneous catalysis
- ❖ Environmental Pollution Abatement; Energy Engineering-Coal /petcoke/biomass gasification;Transport Phenomena; Electrochemical /Oxidative Treatment of Wastes
- ❖ Photocatalysis, multiphase reactors and CFD simulation, Microfluidics
- ❖ Water treatment; advanced oxidation process; membrane technology; adsorption
- ❖ Rheology of complex fluids, Mathematical Modeling and Simulation:

Research Facilities:

1) *FT-IR CARY 660; Agilent Technology USA*
2) *ZETASIZER NANO S90; Malvern, UK*
3) *RHEOMETER - MCR 102; Anton Paar, Austria*
4) *TENSIOMETER DSA 25S; Kruss, Germany*
5) *DENSITY METER; Anton Paar, Austria*
6) *VISCOMETER RHEO LAB QC; Anton Paar, Austria*
7) *UV-VISIBLE SPECTROPHOTOMETER; Thermo Fisher, USA*
8) *HPLC; Agilent Technology USA*
9) *PARTICLE SIZE ANALYZER S3500; Microtrac, USA*
10) *CHNS ANALYZER; Elementar, Germany*
11) *TOC ANALYZER; Elementar, Germany*
12) *DSC-TGA: SDT Q600; TA Instrument, USA*
13) *TGA THERMOSTEP;Eltra, Germany*
14) *ULTRASONIC PROBE; Sonics & Materials, USA*
15) *GC: TRACE GC 700; Thermo Fisher, USA*
16) *KARL ZEISS AXIOSCOPE; Carl Zeiss, Germany*
17) *PLANETARY BALL MILL for Nano-sized Grinding; EGOMA Technologies*

- **Civil Engineering**

  Major Research Areas:

  ❖ Hydrology, Water Resources, Climate Change
  ❖ Soils & foundations; numerical modeling & analysis; stability of slopes; retaining walls, Soil-Structure Interaction, analysis and design of concrete and steel structures, composite structures
  ❖ Structural Dynamics, Computational Mechanics, Bridge Engineering, Structural Materials, Marine Structures
  ❖ Seismic Behavior of Masonry Structures, Earthquake Engineering, Structural Dynamics, Recycled Aggregate Concrete
  ❖ Geotechnical Engineering, Geoenvironmental Engineering, AI and Optimization methods in Geotechnical Engineering
  ❖ Blast Engineering, Impact Mechanics, Structural Concrete and Steel, Construction Materials, Retrofitting of Structures
  ❖ Transportation engineering, Railway Geotechnology, Ground Improvement, Geosynthetics Reinforced Soil Structures, Finite Element Analysis
  ❖ Flow through Porous Media, Groundwater Exploration and Assessment, Integrated Watershed Management

Research Facilities:

1) *Universal Testing Machine.*
2) *Compression Testing Machine.*
3) *Flexural Testing Machine.*
4) *Torsional Testing machine.*
5) *Triaxial Shear Test Apparatus.*
6) *Direct Shear Test Apparatus.*
7) *Consolidation Test Apparatus.*
8) *SPT, CPT, Plate Load Test Apparatus.*
9) *Pipe Friction Apparatus.*

10) *Bernoulli´s Apparatus*

11) *Hydraulic Jump Apparatus.*

12) *Venturi Meter and Orifice Meter Apparatus.*

13) *Flash Point and Fire Point Test Apparatus.*

14) *Penetration Testing Equipment.*

15) *Softening Point Testing Apparatus.*

16) *Viscosity Testing Apparatus.*

17) *Digital Marshall Test Apparatus etc.*

- **Computer Science & Engineering**

  Major Research Areas:

  - ❖ Bioinformatics, Evolutionary Algorithms , Data-mining , Machine Learning, Data and knowledge based systems
  - ❖ Wireless Communication and Networks, Graph Algorithm Problems, Network Security, Content based Image Retrieval, Cryptography
  - ❖ Wireless Networks , Software Engineering, Cloud Computing, Distributed Databases
  - ❖ Cryptography, Wired/Wireless Networking and Security, VLSI Design
  - ❖ Soft computing, Video-on-Demand, Cryptology, Data Mining, Information Retrieval, Network Security, wireless sensor networks, Cloud Computing
  - ❖ Group Security, Ad-hoc and Sensor Network, Artificial Intelligence, Image processing

  Research Facilities:

  1) *SOFTWARE LABORATORIES*
     - ➢ *Sun Sparc Servers*
     - ➢ *IBM Servers*
     - ➢ *HP P4 Servers*
     - ➢ *HP Tower Server*
     - ➢ *Pentium 4 Workstations*
     - ➢ *Thin Clients and high end PCs.*
     - ➢ *Laboratories are fully equipped with software for basic and advanced programming like C/C++, PERL, LISP, Microsoft Visual Studio 6.0, Microsoft Visual Studio .NET, Java Platform Enterprise Edition, IBM Rational Software Architect, Qualnet Simulator, MATLAB SIMULINK. V*
     - ➢ *Various toolboxes like Image Processing, Statistics, Optimization, Neural Network, Fuzzy Logic, Wavelet, Bioinformatics, Signal Processing, DSP System and Communication System.*
  2) *HARDWARE LABORATORY*
     - ➢ *Necessary resources for conducting hands on sessions on fundamental subjects like Digital Circuits, Computer Organization and Architecture, VLSI and Microprocessor Based Systems.*

- **Electrical Engineering**

  Major Research Areas:

  - ❖ Power electronics, Distributed generation, Electric Drives, High Voltage Engineering
  - ❖ Electrical drives, renewable energy sources, Power system, Power electronics, soft computing application in power system, Multilevel converters, Motor Drives,
  - ❖ Integrated optics, optical signal processing, development of optical logic circuit, instrumentation, control system
  - ❖ Control systems: process control, PID controller, model order reduction.
  - ❖ Electric Drives and Electric Signal Processing
  - ❖ Application of high frequency converters, energy efficient devices, energy efficient drive

Research Facilities:

1) *Power Systems Laboratory.*
2) *Switchgear & Protection Laboratory.*
3) *Control Systems Laboratory.*
4) *Electrical Machines Laboratory.*
5) *Analog & Digital Electronics Laboratory.*
6) *Electrical Drives Laboratory.*
7) *Power Electronics Laboratory.*
8) *Electrical Technology Laboratory.*
9) *Circuit Theory Laboratory.*
10) *Simulation Laboratory.*
11) *Microprocessors & Microcontroller Laboratory.*
12) *Electrical Measurement Laboratory.*
13) *Instrumentation Laboratory.*
14) *Mine Electrical Engineering Laboratory.*

- **Electronics Engineering**

  Major Research Areas:

  ❖ Microwave photonics, optical network, Silicon Photonics, Optical Communication semiconductor devices, Wireless communication, cognitive radio, soft computing, Integrated Optics, Signal processing

  ❖ Physical Layer and Signal Processing aspects of Wireless Communication Systems

  ❖ Nano-optoelectronics, nanoelectronics, Modelling and Simulations of MOSFET, CMOS for Low power Application, Analog VLSI Circuit, Analysis and Design of MOSFET and Nano-Devices

  ❖ Modeling and Simulation of Nano-interconnects and Nano devices, Photonics, embedded systems, computational intelligence

  ❖ Solar PV Cell, Gr-IV Optoelectronic Devices- Fabrication and Modeling, Transducer design, controller design and instrumentation system design

  ❖ Microwave Metamaterials Dielectric Resonator Antenna, Dielectric Resonator antennas, MIMO Antennas, bio-electromagnetics

  ❖ Optical fiber communication, RF & microwave engineering, antenna, Signal processing, Electromagnetic theory, Opto-electronic materials, optical fiber communication and optical fiber sensors, Optical communication.

Research Facilities:

1) *MAIN ELECTRONICS LAB*
   Advanced trainer kits, oscilloscopes, function generators and power supplies.
2) *DIGITAL ELECTRONICS LAB*
   Domain of digital electronics. Each standard setup in the lab consists of basic and advanced trainer kits, oscilloscope and function generators.
3) *COMMUNICATION LAB*
   - ➢ *Synthesized function generators, analog oscilloscopes, digital storage oscilloscopes, multiple power supplies and a Pentium-4 PC.*
   - ➢ *100 Mhz 18 channel mixed signal oscilloscope and programmable function generator, LCR data bridges, various modulators and demodulators, filters,*

> *multiplexers and demultiplexers, communication trainer kits, spectrum analyzers, DSP boards*

> ➢ *TIMS hardware and software module with evaluation module etc.*

4) *CONTROL ENGINEERING LAB*

> ➢ *This state –of-the-are laboratory has tools like Matlab with target embedded module with SimuLink, Real-time workshop and toolboxes like control system, signal processing, communication, image processing and neural networks.*

> ➢ *For practical experience on implementation there are LABView with six hardware setups, distributed control system setup with little genie software and ADAm′s hardware module and Silicon Lab PSOCs based on 8051 core with four user Keil compilers.*

5) *DIGITAL SIGNAL PROCESSING LAB*

> ➢ *Matbal and SimuLink (with a set of took boxes) are used for simulation task*

> ➢ *Real-time experiments are carried out using DSP kits from TEXAS Instruments.*

> ➢ *Hardware boards available in the lab are TMS320C31, TMS320C6711 and TMS320CVC33 DSKs.*

> ➢ *TMS320C6701 EVM to experiment with the full capability of the processor.*

> ➢ *One color image acquisition system to take images of objects for further processing with software like Matlab, is also available.*

> ➢ *Beside these, arbitrary waveform generators, Digital Storage Oscilloscopes, scanner and color deskjet printers are also available in the lab.*

6) *Fiber Optics Lab*

> ➢ *Optical spectrum analyzer, lock –in – amplifier, splice machine, DFB Laser diodes, 980 nm Tunable Laser Diode with accessories, 1500 to 1600 nm Tunable laser diode.*

> ➢ *OTDR for 850, 1300 & 1550 nm plug-in units & OTDR Emulation Software LEDs, LD & PDs of different wavelengths different types of connectors, adapters, pigtails, Lenses, polarizers, different types of SM, MM & plastic fibers*

> ➢ *EDFA.*

7) *MICROPROCESSOR LAB*

Field of microprocessor architecture and industrial control through microprocessors. This lab has a large number of 8085 and 8086 microprocessor kits, 8051/31 microcontroller trainer kits with assembler/compiler and development system facilities and various add-on cards like A/D converters, stepper motor controller kits, interfacing cards and simulator cards.

8) *MICROWAVE LAB*

Study of microwave and antenna design, characteristics and properties.

- *Consists of a number of setups each equipped with Klystron tubes, Gunn diodes, Klystron power supplies, Modulators, directional couplers, various power energy and VSWR meters etc.*
- *Antenna system trainers complete with 40 to 850 MHz receiver/transmitter, antennas and analysis software.*
- *Satellite communication system trainer kit to impart advanced skills to its students. This lab also has IE3D Simulation software for microwave circuit simulation and analysis.*

9) *NANO-ELECTRONICS AND ANALOG CIRCUITS LAB*

Project lab sponsored by Ministry of Human Resource and Development (MHRD), Govt. Of Indian.

- *Nano-scale device modeling project and another with analog circuits. This lab has a number of P4 PCs equipped with Matlab and SimuLink, MultiSim with analog and digital and mixed mode circuits and also PCB layout design.*
- *Facilities of hardware implementation of simulated analog circuit.*
- *Medici Device Simulation software for advanced level device modeling and simulation.*

10) *COMPUTER LAB*

- *PCs with multiuser design and analysis software like Matlab, ORCAD, Spice and VHDL.*

- **Environmental Science and Engineering**

Major Research Areas:

- ❖ Water and wastewater engineering, groundwater remediation, solid waste management
- ❖ Environmental ecology, microbiology, biogeochemistry, biogeochemistry of terrestrial and aquatic ecosystems, biodiversity
- ❖ Coal mine planning, Mine Plan and Mine Closure Plan design, operation, safety, environment, Mine environment, land reclamation, fly-ash utilization, mine fill, mine closure.
- ❖ Environmental Biotechnology, Biodiesel From Algae; Biodiversity; Molecular Taxanomy; Bio-harvesting, Microbial-remediation of pollutants
- ❖ Sustainable Nanomaterials for Environmental & Energy Applications, EIA & Auditing
- ❖ Carbon foot printing, Air pollution dispesion modeling, vehicular pollution & traffic modeling.

Research Facilities:

1) *INSTRUMENTATION LABORATORY*
   - ➤ *Spectrophotometer (UV-VIS-IR, Shimadzu UV-256). Gas Chromatograph*
   - ➤ *AAS – GBC Avanta & GBC-902 including Graphite Furnace GBC GF 3000;*
   - ➤ *Mercury Analyser (MA 5800E)*
   - ➤ *Particle Size Analyser (CILAS/1064 liquid/dry, USA), laser based attached with online image capturing facilities.*
   - ➤ *TCLP Apparatus including Zero Head Space Extractor, Dispensing Pressure Vessels, Rotary Agitator & Vacuum Pressure Pump (Millipore)*
2) *SOIL QUALITY & SOIL MECHANICS LABORATORY*
   - ➤ *Field Kits for Water Holding Capacity, Infiltration Rate etc.*
   - ➤ *Sieve shaker, Muffle furnace;*
   - ➤ *pH & Conductivity Meters, Atterburg Limit Apparatus*
   - ➤ *Cone Penetrometer, Infra-red Moisture Meter*

- *Triaxial Test Apparatus, Permeameter (Falling & Constant head)*
- *Consolidation Test Setup*
- *Relative Density Apparatus,*
- *Sedimentation Test Setup,*
- *Universal Automatic Compactor*

3) *WATER CHEMISTRY LABORATORY*
- *pH Meter with combined glass-calomel electrode (Cyber Scan 510, MEPC);*
- *TDS/Conductivity Meter (Cyber Scan 200, MERCK);*
- *Spectrophotometer (Spectroquant, NOVA 60, MERCK;*
- *Flame Photometer (Microprocessor based, Model 128);*
- *COD Meter (Spectroquant, TR 320 MERCK) (148°C);*
- *Turbidity Meter (MERC, Turbiquant 3000T; 0-1000 NTU);*
- *Immersion Thermostat (LAUDA, E100) – Bath/Circulation Thermostats*
- *BOD Incubators;COD Reflux Units;Double Distillation Units.*

4) *ENVIRONMENTAL MICROBIOLOGY LAB*
- *Continuous Weather Monitoring Station (Envirotech WM-300) – 1 no;*
- *Mechanical Wind Recorder (Wilh Lambercht Gmbtt Gottingen Type-1482) – 3 nos; Raingauge*

5) *MICROMETEOROLOGICAL LAB*
- *Universal Trinocular Research Microscope (OLYMPUS, BX60) – Digital Camera with online image capturing & analysis, Micro Image lite 4.0*
- *Trinocular Stereozoom Microscope (LEICA, 56D, 6.3:1) – Cold light illumination system, Leica CLS 150 X*
- *Millipore Membrane filtration for Coliform Organisms, Chlorophyl content meter*
- *Colony Counter (Electronic); Laminar Flow Chamber (horizontal)*
- *Leaf Area Meter (Systronics), Research Centrifuge (REMI R24)*
- *Autoclave, ph & EC meter, Student Binocular Micrscope (NIKON) – 10Nos*
- *Student Stereozoom Microscope – 10 Nos (LEICA)*

6) *LAND USE & HYDROGEOLOGY LAB*
- *Stereoscopic Microscope*
- *Ground truth Radiometer*
- *Optical Pentograph with 5x magnification, Clinometer, Rotameter*
- *Liquid Permeameter (Ruska Haustan)*
- *Electronic Digital Planimeter, Automatic Water Level Recorder.*
- *AQUA CHEM and Aquifer Pro Software's*

7) *NOISE QUALITY MONITORING LAB*
- *Modular Precision Sound Level Meter with octave filter set (Bruel & Kjaer)*
- *Sound Level Meter (CRL-703A, Cirrus)*

- ➢ *Modular Sound Analyzer (Bruel & Kjaer)*
- ➢ *Noise Dose Meter (Bruel & Kjaer,)*
- ➢ *Dosimeter (CEL 420), Audiometer (AP 251, Alfred Peters Ltd)*

8) RADIATION LAB

- ➢ *Alpha – Counter (Nucleonix, AP165)*
- ➢ *Beta - Counter (Nucleonix, Minibin, MB 403)*
- ➢ *Lead Chamber (Nucleonix, Minibin, MB 403)*
- ➢ *Radon Bubblers (Polltech Instruments)*
- ➢ *Radiation Survey Meter (Nucleonix, UR705)*
- ➢ *Nal (T1) Detector (International Environment, 4K MCA with software 127A102/5A)*
- ➢ *Radon Counter (Polltech Instruments, PS1-PCS1)*
- ➢ *Lucas Cell (Polltech Instruments, PS1-RCD1)*
- ➢ *Radioactive Standards (Nucleonix)*

9) FLUID MECHANICS LAB

- ➢ *Venturimeter, Orificemeter, Bernoullie′s Apparatus*
- ➢ *Reynold′s Apparatus Pitot Tube, Display Model of Centrifugal Pump*

10) AIR POLLUTION LAB

- ➢ *High Volume Air Sampler & Respirable Dust Sampler (Envirotech)*
- ➢ *Real Time Aerosol Monitor (RAM-1), Gravimetric Dust Sampler*
- ➢ *Cascade Impacter (Sera Anderson), Fume Hood Chamber*
- ➢ *Personal Dust Sampler (Envirotech), Stack Monitoring kit (Envirotech)*
- ➢ *HVS Calibration kit (Envirotech)*
- ➢ *Green House Gas Monitor , Portable CO Monitor (ENDEE)*
- ➢ *Auto Exhaust Monitors for Diesel & Retrol Driven Vehicles (CO & HC)*

11) WASTEWATER ENGG. LAB

- ➢ *SBR, UASB, Hybrid and ASP Reactors,*
- ➢ *Temperature Controlled Incubator cum Shaker*
- ➢ *High Speed Refrigerated Centrifuge*
- ➢ *Digesdhal Apparatus , COD Reactor, Stirrers*
- ➢ *Soxhlet Extraction Assembly , Microprocessor based Muffle Furnace*
- ➢ *UV-Visible Spectrophotometer , Gas Chromatograph &Vacuum Filtration Unit*

12) WEATHER STATION

- ➢ *Automatic weather station to provide the weather related information (Max. Min. Temp, R.H, Wind Speed and Direction, Rainfall, etc.) to the public on regular basis.*

13) LAND SURVEYING

- ➢ *Theodolite, Levels, Chain Survey Setup, Ranging rods, Plane Table Survey Setups, Magnetic compass*

14) REMOTE SENSING & GIS LAB

- ➢ *ERDAS 9.1, A0 Size HP T1100 Plotter, A0 Size HP 4500 Scanner, Recent & Archive satellite data of different coalfields*

- **Fuel & Mineral Engineering**

Major Research Areas:

- ❖ Dense medium cyclones, industrial minerals processing, Fine particle processing, flotation, bio mineral processing, hydrometallurgy, pelletisation
- ❖ Coal combustion, Clean coal technology, Renewable energy, Water treatment technologies, Membrane separation process, Dewatering, Froth flotation, flocculation.
- ❖ Gravity concentration, Equipment Design and Development, Innovation and Technology Development
- ❖ Fuel technology, coal carbonization & coal combustion
- ❖ Extractive metallurgy, materials science, wear and tear
- ❖ Coal preparation process flowsheet development policy research

Research Facilities:

1) *CRUSHING & GRINDING*
   - ➢ *Jaw Crusher*
   - ➢ *Roll Crusher*
   - ➢ *Coal Crusher*
   - ➢ *Ball Mill*
   - ➢ *Pot Mill*
   - ➢ *Vibrating Mill*
   - ➢ *Laboratory Work Index Ball Mill*
   - ➢ *H G I apparatus*
   - ➢ *Fritsch Pulverisers*
2) *SIZING AND CLASSIFICATION*
   - ➢ *Warman Cyclosizer*
   - ➢ *Pipette centrifuge*
   - ➢ *BET apparatus*
   - ➢ *Pneumatic Classifier*
   - ➢ *Hydro-Classifier*
   - ➢ *Spiral Classifier*
   - ➢ *Cyclone separator*
   - ➢ *Compu-sieve*
   - ➢ *Laser beam particle counter*
3) *ANALYTICAL FACILITIES*

- Atomic absorption spctrophotometer
- Flame Photometer
- Quantosorb
- Metallurgical Microscope
- Electronic Balance
- Rheo viscometer
- DVIII Programable viscometer
- Digital pH meter
- Zetameter
- Thermal analyser (DTA/TGA/DSC)
- CHNS & O Analyser

4) DEWATERING
- Disk filter (continuous)
- Leaf filter
- Pressure filter
- Belt filter

5) BENEFICIATION UNITS
- Denver Mineral jig
- Hartz jig
- Wilfley table
- Mozley mineral separator
- Mozely vanner
- Multi-Gravity Separator
- Fagergren flotation cell
- Agitair floatation cell
- Special Denver type flotation cell
- Heavy media separator
- 3″ & 4″ Water only cyclone test rig
- 3″ Vorsyl Separator
- 3″ & 4″ Dense Medium Cyclones
- Devis Tube Magnetic separator
- Wet drum magnetic separator
- Perm roll magnetic separator
- Electrostatic separator

6) AGGLOMERATION
- Oil Agglomeration cell
- Disc pelletiser
- Drum pelletiser
- Flocculation test unit
- MISCELLANEOUS
- High speed centrifuge
- Washing drum scrubber

- ➤ *Industrial Dryers*
- ➤ *High temperature furnace*

7) *PILOT PLANT FACILITIES*
- ➤ *Humphrey spiral test-rig*
- ➤ *100kg/hour flotation unit*
- ➤ *Hydro-cyclone/Heavy media tet-rigs*
- ➤ *Cyclone test rig apparatus*
- ➤ *50 & 60 mm Column flotation rigs*
- ➤ *Continuous flotation cell*

8) *COAL & COKE ANALYSIS LAB*
- ➤ *Proximate analyser*
- ➤ *CHNSO analyser*
- ➤ *Calorimeter*
- ➤ *Free Swelling Index apparatus*
- ➤ *Low Temperature Gray King Assay Furnace*
- ➤ *Shatter & Micum Index facilities*
- ➤ *Drum test apparatus*
- ➤ *Coke Reactivity Index (CRI) and Coke Strength after reaction (CSR) apparatus*

- **Humanities and Social Science**

  Major Research Areas:

  - ❖ Ethics and philosophy of action, philosophy of mind, philosophy of language professional ethics
  - ❖ Cultural studies, Popular Culture
  - ❖ Buddhist Philosophy, Metaphysics, Comparative Philosophy, Philosophy of Religion and Ecology
  - ❖ ELT/ESP, language testing
  - ❖ Theatre and performance studies, translation studies ,Indian English literature,
  - ❖ Contemporary literary theory, contemporary Indian English fiction, literature of Indian diaspora, gender issues, and professional communication.
  - ❖ Ethics and Applied ethics

- **Management Studies**

  Major Research Areas:

  - ❖ Consumer behaviour, social marketing, cognitive dissonance, choice dynamics and sustainable marketing
  - ❖ Operations management, Operations Research, Operations Management, Supply Chain Management, Capital market, entrepreneurship management
  - ❖ Finance Management, Financial accounting, management accounting
  - ❖ Human motivation, human recourse development, consumer psychology
  - ❖ Applied Econometrics, Environmental and Natural Resource Economics
  - ❖ Advertising, marketing and human resources management
  - ❖ Decision Sciences, Reverse logistics, Quality and Reliability Analysis
  - ❖ Online Marketing, Strategic Management

- **Mechanical Engineering**

Major Research Areas:

- ❖ Un-conventional machining, micro-machining, materials engineering, Non-conventional machining processes, Nano-fluids, surface engineering, production management
- ❖ Solid mechanics, fracture mechanics, Vibration damping, FEM, Plate/Shell structures, Composites, acoustics, vibration, Nanostructured & Nanocomposite Materials
- ❖ Drop evaporation, shedding, drop impact on various surfaces, flow diagnostics
- ❖ CAD/CAM, curve and surface modeling, CFD, Finite element in fluids, Bluff body aerodynamics
- ❖ Advanced manufacturing, Advanced Nano Composite Materials, Fracture Mechanics & Contact Mechanics
- ❖ Machine Design, Tribology; Lubrication and bearing Design, Vibration of plated structure (FGM Plates, Nano plates, Plates on foundation), Structural acoustics, metal casting
- ❖ Statistical quality control /statistical process control, manufacturing process/workshop technology
- ❖ Heat Flux Measurement Analysis in Microseconds, Internal Combustion Engine, Two Phase Flow Analysis, Nanomaterials and Nanofluids
- ❖ Rotor dynamics, Machinery condition monitoring, Signal processing in mechanical systems
- ❖ Thermodynamic Optimization, Energy Storage, Heat Transfer, Fluid Mechanics, , Solar Energy
- ❖ Fluid Mechanics, Hydraulic Machines, Pipe Network, Renewable energy, Water Resources
- ❖ Tribology, Nano-Lubrication, Turbo-machinery and Cryogenics

Research Facilities:

1) Vapour compression refrigeration cycle test rig
2) Refrigeration and air-conditioning accessories display and cut models
3) Ice plant experimental setup
4) Pyranometer - Solar Radiation Recorder
5) Clean Energy Trainer – Experiment Set for Energy Generation, Storage and Supply
6) Computerized 4-S, 4-Cylinder Petrol Engine (Power: 47 kW @ 5500 RPMM, Max. Torque: 96 N-m @ 3000 RPM)
7) Computerized Single Cylinder, 4-S Dual Fuel (Diesel and Petrol) Variable Compression Ratio (VCR) Engine
8) Jet Plate and Longitudinal Fins Solar Air Heater
9) Plate Type Heat Exchanger
10) Concentric Tube Heat Exchanger (Plane and Finned: Comparator type)
11) Cross –Flow Heat Exchanger
12) Drop wise and Film wise Condensation Apparatus
13) 4-stroke, 4-cylinder Turbocharged, inter-cooled Diesel engine experimental set-up with hydraulic dynameter
14) Diesel Engine Smoke Meter
15) Exhaust Gas Analyzer
16) Twin Rotor MIMO System
17) Inverted Pendulum
18) Universal Governor Apparatus
19) Static & Dynamic Balancing Apparatus
20) Universal Vibration Apparatus
21) Cam Analysis Apparatus
22) Motorized Gyroscope
23) Whirling of Shafts Demonstrator
24) Model of Brakes consisting of: a) Single Shoe Brake b)Double Shoe Brake c)Band & Block Brake d)Internally Expanding Brake e)Disc Brake f)Mechanical Brake System
25) Model of Clutches consisting of: a) Conical Friction Clutch b) Plate Clutch c) Centrifugal Clutch d) Multiplate Clutch e) Model of Geneva Wheel Drive
26) Kaplan Turbine Experimental Set up
27) Pelton Wheel Experimental Set up
28) Multiple experimental set up of • Verification of Bernoulli's Theorem
29) Apparatus for measuring losses in pipe
30) Calibration of a circular orifice
31) Calibration of Venturimeter
32) HAMMER Software (BENTLEY LTD.) - Pipe Network Transient Analysis Software
33) Sine Wave Vibro Viscometer

34) Ultrasonicator
35) Stabinger Viscometer
36) Pin on Disc Wear Measuring Machine
37) Ferrogram Maker
38) ANSYS − an engineering simulation software developer.
39) ABAQUS − a calculating tool used primarily in parts for performing arithmetic processes.
40) ALTAIR-HYPERMESH is a high-performance finite element pre-processor for popular finite element solvers.
41) COMSOL - an engineering design and finite element analysis software environment for the modeling and simulation.
42) Universal testing machine
43) Micro Hardness Testing Machine
44) Torsion Testing Machine
45) Mechanical Vibration Laboratory
46) STAR CCM CFD Software − provides comprehensive engineering physics simulation inside a single integrated package

- **Mining Machinery Engineering**

  Major Research Areas:

  ❖ Fluid power system, machine design, fluid power & control, mining equipment design and selection

  ❖ Condition based maintenance, mining machinery, material handling equipment , Condition monitoring of electric drives, mine electrical engineering

  ❖ Internal combustion engines, Thermodynamics, Reliability and Maintenance Engineering

  ❖ Mechanical behaviour of materials, fatigue and fracture, Continuum Damage Mechanics (CDM), Failure Analysis

  ❖ Fracture Mechanics, FRP composites, FEM, Adhesive bonding, FGM, Rock Fracture, design of hydrostatic transmission system.

  ❖ Vortex Tube Refrigeration & Air Separation, Computational Fluid Dynamics, Geothermal Energy, Power electronics, instrumentation, Mine Electrical

  ❖ Thin Film Gauges, Clad failure analysis, heat and mass transfer analysis, refrigeration and air-conditioning

Research Facilities:

1) *A Computer controlled Closed Circuit and Open circuit Hydrostatic Transmission System of 15 kW capacity*
2) *Computer controlled Laboratory Model Hydraulic Excavator*
3) *Computer controlled Proportional valve controlled hydraulic motor test set-up of 7.5 kW capacity*
4) *Hydraulic system with Accumulator*
5) *Programmable Logic Controlled Two-Motor Hydrostatic Summation Drive*
6) *Hydrostatic transmission system with pump loading*
7) *Reciprocating Air Compressor Experimental Set up*
8) *Blower Testing Rig*
9) *Two Stage Axial Flow Fan Testing Rig*
10) *System Simulation Software – SYMBOLS Shakti Release 2.0.1 software, Academic offline mode*

11) Apron conveyor
12) Ground mounted friction winder
13) Drum winder
14) Direct rope haulage
15) Mono-cable aerial ropeway
16) Belt conveyor with loop take-up system
17) Torsional rigidity test setup for steel wires ropes
18) Mine track layouts
19) Steel wire fatigue strength measuring setup
20) Electro-magnetic type vibratory feeder
21) Hopper vibratory feeder setup
22) Vibratory screen
23) Experimental setup for friction angle determination
24) Tandem gear drive arrangement of belt conveyor
25) Jackhammer drill machine assembly with its mounting detail and screw-feed mechanism
26) Diamond drill machine
27) Wagon drill machine with its different accessories for study purpose
28) Tri-cone roller bit
29) Button bit
30) Drill mud viscosity measuring setup

- **Mining Engineering**

Major Research Areas:

- ❖ Rock mechanics, Explosive Engineering, Rock Blasting Technology, Rock Excavation Engineering, Opencast Mining
- ❖ Drilling & blasting technology, underground metal mines, computer aided mine planning, tunnel engineering, Mechanical cutting, Tunnelling
- ❖ Mine ventilation and environmental engineering, groundwater, slope stability
- ❖ Mine Surveying, GIS & Remote Sensing, IT application in mining
- ❖ Mine systems Engineering, Underground Coal Mining, Mine Planning and Design
- ❖ Mine Subsidence Studies using SAR Interferometry Technique, Numerical Modelling, and GPS/GNSS; Underground Metal Mining; Mine Safety Engineering, Mine Ergonomics, Wireless Communication and Environment Monitoring in Mining
- ❖ Risk assessment and Safety Management, Emergency Response & Disaster Management, Accident investigation, Mine fire and explosion
- ❖ Geomechanics, Slope Stability Engineering, and Image Processing Technology for Geo-Resource Utilisation
- ❖ Photogrammetry, Cartography, Remote sensing, GIS and GPS

Research Facilities:

1) *ROCK MECHANICS LABORATORY*
   - ➢ *Material Testing System (MTS), (100 tones),an electro‑hydraulic stiff testing machine, is used for testing the various physico‑mechanical properties of rocks under different conditions of loading.*
   - ➢ *Compression testing machine (600 tones), is used for determining various strength parameters of rocks & building materials and for testing of mine supports including hydraulic legs for longwall roof support.*
   - ➢ *Transducers and Sensors, consist of precision Load Cells, Pressure Transmitters, Pressure Transducers, Strain Gauges and LVDTs. These are*

invariably used with on-line PC based Data Acquisition System for recording test parameters.

➢ *PC Based Data Acquisition System, a state of the art 8-Channel Data Acquisition System with sampling rate of 9999 samples per second for on-line acquisition of test data like strain, displacement, pressure, load, temperature etc. This is used invariably in all the laboratory experiments.*

➢ *MINIFRAC, is used for determining the in-situ stresses in rock mass by hydro-fracturing technique.*

➢ *Hydraulic Leg testing facility, for testing Powered Roof Support used in longwall mining. This is a DGMS approved facility.*

➢ *Extensometers, Convergence Recorders, Vibrating Wire stress/strain meters and other modern instruments.*

The laboratory has facilities for soil testing, coring, cutting and polishing of rock samples, as well as, equipment for determining cuttability, drillability, abrasivity, weatherability, empirical strength indices and other properties of rocks.

2) *ROCK EXCAVATION LABORATORY*

➢ *High speed video camera, for study of mechanics of rock fragmentation and movement of rock mass and projectiles.*

➢ *Fragblast softwares, for rock fragmentation and distribution analysis using the digital images acquired by a video camera.*

➢ *Vibration recorders and sophisticated chip based micro seismographs, to record blast vibration levels and analysis for peak particle velocity, dominant frequency, FFT analysis and safe vibration levels.*

➢ *VOD probe, for measuring velocity of detonation of explosives inside a blast hole.*

➢ *Digital storage oscilloscope along with borehole pressure transducer, for recording detonation pressure inside blast holes.*

➢ *Cerchar hardness apparatus, for estimation of drilling parameters and machine specification from small rock samples.*

➢ *Sequential blasting machine, for providing very precise and wide range of delays in blasting circuits.*

➢ *Near-field acceleration measuring setup, for understanding rock-explosive interaction for blast damage assessment.*

3) *MINE VENTILATION AND ENVIRONMENT LABORATORY*

➢ *Precise instruments, for carrying out pressure – quantity surveys in mines.*

➢ *Experimental set up, for studying methane emission from coal seams.*

➢ *Quick thermal conductivity meter, to measure the thermal conductivity of rocks.*

- *Real time aerosol monitor, gravimetric dust sampler, personal dust sampler, konimeter with projector for studying the air borne respirable dust concentration in mine air.*
- *Digital sound level meter with recorder, for studying noise levels in mines and mining areas.*
- *Facilities for studying CPT and IPT, SZ index and U index for finding the susceptibility of coal to spontaneous heating.*
- *Experimental set-up, to study coal-dust explosion hazard.*
- *Microprocessor based Gas Chromatograph System, for detection and measurement of different gases in the mine air.*
- *Mine ventilation computation laboratory, for computation of ventilation problems, is a part of the Mine Ventilation and Environment Laboratory.*
- *Artificial lung machine and related set-up, for simulation of rescue operations in mines, the first of its kind in an educational institution.*

4) *SURVEY LABORATORY*
- *Electronic total station, for all types of spot surveying with high speed and accuracy.*
- *Gyro theodolite, for determination of true North.*
- *Laser eye piece, for correlation survey.*
- *Micro-optic theodolites, precise levels and other instruments, for all types of surveying and leveling.*
- *Global Positioning System (GPS)*
- *Mine surveying computation laboratory forms a part of the Survey Laboratory.*
- *Digitiser and plotter for development of survey plans.*
- *GIS Softwares, for extracting and processing the information from mine plans and to update them with the latest information.*

5) *COMPUTER AIDED MINE PLANNING AND DESIGN (CAMPAD) LABORATORY*

A large number of stand-alone PCs with LAN and internet connections loaded with mining related softwares allow students to gain hands-on experience of solving the problems assigned to them and for developing problem specific solution programs.
- *SURPAC Vision 5 Mine Planning Software package, for mine planning and design.*
- *Multi-media computer system, for development of computer based training packages.*
- *GRAFEX, VIBAN, VENTSYS and good number softwares developed in-house.*
- *MATLAB 6 for simulation & modeling*

6) *PIPELINE TRANSPORTATION LABORATORY*
- *Pilot scale facility for study of the characteristics of slurry transportation through pipelines.*

7) *LONGWALL MINE MECHANIZATION LABORATORY*
   ➤ *An unique 30 Meter longwall mock gallery with Powered Support, Shearer, AFC, Stage Loader, Power Pack etc where the students can have their practical, a facility which is not available in any other institute in India. The gallery is fitted with an Environment monitoring package which is connected to the computer.*
   ➤ *Laboratory set up to study Mine Roadway losses, Mine Ventilation network, Mine Fan performance, Support Hydraulics are also available. Various types of Air flow measuring units, personal sampler, Methano meters for field study as well as Load Cell, Extensometer, CERCHER apparatus, Shore Sceleroscope, NCB Cone indenter are available for such studies.*

8) *MINE SYSTEMS LABORATORY*
   A large number of stand-alone PCs with LAN and internet connections loaded with mining related softwares to allow students to gain hands-on experience of solving the problems assigned to them and for developing problem specific solution programs.

9) *NUMERICAL MODELING LABORATORY*
   Pentium IV multimedia PCs connected to a high performance server. Following softwares are available in the Numerical Modelling laboratory for mine design and numerical simulation of geo-mining problems:
   ➤ *Strand – 7 (version 2.3.4) finite Element Package, for solving 2-D & 3-D linear and non-linear static and dynamic problems.*
   ➤ *FLAC – 2D software (Version 4.0), Finite difference software for solving linear and non-linear and support problem of excavations in rock.*
   ➤ *ANSYS 10. Finite Element Modelling Package for solving linear and non-linear problems including support problems for excavations in rock.*

- **Petroleum Engineering**

  Major Research Areas:

  ❖ Chemical enhanced oil recovery, synthesis and characterization of surfactants, Alkali-surfactant-polymer flooding, Water shutoff and Profile modification jobs

  ❖ Fluid Characterization, Compositional Flow Simulation, PVT Simulation, Multiphase Behavior and Thermodynamics, Near Critical Phase Behavior,

  ❖ Drilling fluid; Reservoir Fluid Thermodynamics; Fluid Flow Through Porous Media; Drilling fluid design and analysis & Cements

  ❖ Separation of oil from oil-water emulsion, Environmental Management in Petroleum Operations. multiphase flow, Membrane Separation, scale & corrosion, paraffin, sand control

  ❖ Biomass and Bioenergy; Carbon Dioxide Sequestration;; Oxidation of Fatty acids; Multi-objective Optimization

  ❖ Reservoir Engineering, Testing & evaluation of oil, gas, CBM and shale gas resources, oil & gas field development, Hydrofracturing Fluids, Unconventional Reservoirs

  ❖ Flow assurance problems, gas hydrates, remedy for waxy and paraffinic crude oil

Research Facilities:

1) *Drilling Fluid and Cementing Laboratory*
   - *Standard methods for testing drilling fluids*
   - *Colloidal properties of clays*
   - *Filtration properties, effects of treating agents*
   - *Effects of contaminants and chemical treatments*
   - *Solids analysis, HTHP testing, lubricity*
   - *Viscous characteristics and control of properties*
   - *Low water loss, salt water drilling fluids, and alkalinity determination*
2) *Product Testing Laboratory*
   - *State-of-the-Art product testing laboratory is having all the modern equipments to measure Specific Gravity/Density, Kinematic Viscosity, Viscosity Index, Ash Content (by Wt), Carbon Residue, Sulphur Content, Flash Point, Water Content, Pour Point, Oxidation Test, Foaming Characterstic, Acidity, Reid*

Vapour Pressure, Evaporation Loss, Asphaltene Content, Trace Metal (V,Ni,Cu etc in ppm), Gross Calorific Value (in K. cal/Kg) etc.

3) Enhanced Oil Recovery Laboratory
   - Reservoir condition waterflood and chemical flood apparatus
   - PVT Apparatus
   - Gas chromatograph
   - Long Core Apparatus
   - High temperature/high pressure analysis
   - Ruska positive displacement pump

4) Gas Hydrates Laboratory
   - Sophisticated equipment in this lab is devoted to understanding the growth and dissolution of gas hydrate crystals.

5) Process Engineering Laboratory :
   - Modern equipment enables students to evaluate heat transfer coefficient, mass transfer coefficient, on-off control, boundary layer thickness, viscosity measurement and frictional loss, flame propagation, filmwise and dropwise condensation, etc.

6) Instrumental Analysis & Measurement Laboratory :
   - Rheometer, viscometer, tensiometer, optical microscope etc.

7) Computer and Simulation Lab :
   - IHS Softwares (20 Network License)
   - PERFORM – NODAL analysis, well/flowline optimization
   - SubPUMP – Industry's leading unbiased, vendor-neutral electric submersible pump design and analysis
   - Pipesoft-2: Surface network simulator with three solution methods and powerful output visualization
   - OilWat®/GasWat® : Comprehensive material balance analysis (conventional and generalized)
   - GasLIFT: Easy-to-use design for gas lift
   - VolOil/VolGas : Volumetrics, Monte Carlo and estimated recoveries
   - PVTLIB : Black oil/compositional properties, over 140 correlations
   - RAPTOR : Fast well test analysisEPS Software (single Network license) donated by Weatherford Oil Tool Middle East Ltd.
   - Wellflo : well modeling software. Wellflow is an easy-to-use Windows based simulator that calculates pressures, temperatures, flowrates, liquid holdup and velocities in a wellbore. The software is specially designed to help as a diagnostic tool for uncontrolled well situations or to be used in contingency planning for new well.
   - MatBal: reservoir analysis and production forecasting

➢ *PanSys: well test analysis*

8) *PETROLEUM EXPERT SOFTWARE: (10 network license) :*
   ➢ *PROSPER: Well Modelling and Design*
   ➢ *MBAL: Reservoir Analytical Simulation Version 9*
   ➢ *PVTP : Fluid Characterisation Version 8*
   ➢ *GAP : Multiphase Network Optimisation Version 7*
   ➢ *REVEAL : Specialised Reservoir Simulator & Near Wellbore Reservoir SimulatorRESOLVE:*
   ➢ *Integrated Production Controller Version 3.*

9) *KAPPA ENGINEERING SOFTWARES (network license):*
   ➢ *Ecrin v4.0 includes the following softwares:*
   ➢ *Diamant: data management*
   ➢ *Saphir (NL): Pressure Transient Analysis*
   ➢ *Topaze (NL): Production Analysis*
   ➢ *Rubis: Reservoir simulator*
   ➢ *Emeraude: Production logging module*