Department of Civil & Environmental Engineering Education: Major Facilities

There are six laboratories in the department.

Contents

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Advanced Material Testing Laboratory

The Advanced Material Testing Laboratory is a state-of-the-art facility equipped with cutting-edge machinery and instruments designed to support comprehensive testing and evaluation of construction and engineering materials. This lab houses a Universal Testing Machine (UTM) with a capacity of up to 2000 tons and a Compression Testing Machine (CTM) rated up to 500 tons, enabling the precise assessment of material strength under extreme loads. In addition to these high-capacity machines, the lab is fully equipped with testing equipment for evaluating the properties and quality of cement, aggregates, and bitumen. These capabilities ensure that a wide range of tests—covering mechanical, physical, and chemical properties—can be performed in accordance with national and international standards, making this laboratory an essential hub for academic research, quality assurance, and innovation in materials science and civil engineering.

Key Functionalities of Advanced Material testing Laboratory:

High-capacity strength testing: Perform tension, compression, and flexural strength tests using UTM (up to 2000 tons) and CTM (up to 500 tons).

Comprehensive material analysis: Test the mechanical and physical properties of cement, aggregates, and bitumen.

Quality control and assurance: Evaluate construction materials to ensure compliance with IS, ASTM, and other relevant standards.

Durability and performance testing: Conduct long-term performance assessments of materials under various environmental conditions.

Research and development support: Facilitate advanced research in material science, including the development of innovative and sustainable construction materials.

Hands-on training and education: Provide practical learning opportunities for students and professionals in material testing procedures and analysis.

Universal Testing Machine

Advanced Material Testing Laboratory


CONST. MATERIALS TESTING LAB


CONST. MATERIALS TESTING LAB

Geo-technical Engineering laboratory

The Geotechnical Engineering Laboratory is a dedicated facility designed for the investigation and analysis of soil and foundation behavior, essential for safe and efficient civil engineering design. Equipped with a comprehensive range of modern testing instruments, the lab supports detailed characterization of soil properties, including shear strength, permeability, compaction, consolidation, and bearing capacity. Key equipment includes triaxial shear test apparatus, direct shear test setup, unconfined compression testing machine, and advanced soil classification tools. The laboratory provides hands-on experience for students and researchers, enabling accurate assessment of subsurface conditions and contributing to the design of stable foundations, earthworks, and geotechnical structures in accordance with national and international standards.

Key Functionalities of Geotechnical Material Testing Laboratory:

Soil classification and characterization: Conduct sieve analysis, Atterberg limits, and specific gravity tests for soil identification.

Shear strength testing: Perform direct shear, triaxial, and unconfined compression tests to evaluate soil strength under different loading conditions.

Permeability and compaction testing: Determine soil permeability and optimum moisture content for effective compaction control.

Consolidation analysis: Measure settlement and compressibility of soil layers for foundation design.

Bearing capacity evaluation: Assess soil's ability to support structural loads through plate load and CBR testing.

Support for foundation design and site investigation: Provide essential data for geotechnical design of buildings, roads, and other infrastructure.

Educational and research applications: Enable practical training, project work, and research in soil mechanics and foundation engineering.

GIS and Simulation Lab

The GIS and Simulation Laboratory is a modern, technology-driven facility dedicated to the spatial analysis, modeling, and simulation of real-world scenarios for advanced planning and decision-making in engineering and environmental domains. This lab is equipped with high-performance computing systems, advanced GIS software (such as ArcGIS, QGIS), and simulation tools used for geospatial data processing, remote sensing, transportation modeling, urban planning, and environmental impact analysis. The lab enables users to visualize, analyze, and interpret spatial data with precision, making it a critical resource for both academic research and practical applications in infrastructure development, resource management, and smart city planning. Through real-time data integration and scenario-based simulations, this lab bridges the gap between theoretical concepts and real-world geospatial challenges.

Key Functionalities of GIS and Simulation Laboratory:

Geospatial data analysis and visualization: Process and interpret spatial data using tools like ArcGIS and QGIS for mapping and spatial decision-making.

Remote sensing applications: Analyze satellite imagery and aerial photographs for land use, environmental monitoring, and disaster management.

Urban and regional planning: Simulate urban growth, infrastructure development, and zoning through GIS-based modeling techniques.

Transportation and traffic simulation: Model traffic flow, network performance, and route optimization for transportation planning and management.

Environmental impact assessment: Simulate and evaluate the environmental consequences of various development projects using spatial datasets.

Resource management: Support planning and conservation of natural resources such as water, forests, and agricultural land through spatial modeling.

Smart city and infrastructure planning: Develop GIS-based solutions for smart governance, utility mapping, and urban infrastructure management.

Educational and research support: Provide students and researchers with hands-on experience in GIS tools, spatial analysis, and simulation models.

GIS and GNSS Equipment

Total Station

Computer-Aided Design (CAD) Lab

The Computer-Aided Design (CAD) Laboratory is a specialized facility equipped with advanced hardware and industry-standard software to support the design, drafting, and modeling needs of engineering students and professionals. This lab serves as a hub for developing 2D drawings, 3D models, and complex simulations using tools such as AutoCAD, SolidWorks, Revit, and ANSYS. It enables users to visualize and refine engineering concepts with precision and efficiency, enhancing their design thinking and technical skills. The CAD Lab plays a crucial role in bridging the gap between theoretical knowledge and practical design applications across civil, mechanical, electrical, and architectural engineering domains, fostering innovation and accuracy in modern engineering practices.

Key Functionalities of Computer-Aided Design (CAD) Laboratory:

2D drafting and detailing: Create precise technical drawings and architectural plans using software like AutoCAD.

3D modeling and visualization: Design and visualize complex components and assemblies using SolidWorks, CATIA, or Revit.

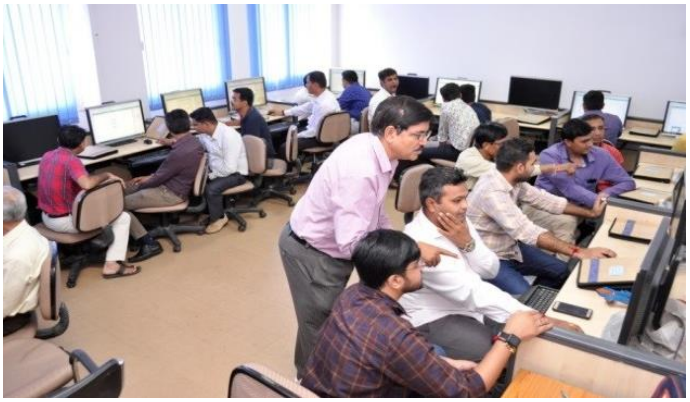
Structural and mechanical simulation: Perform stress analysis, motion simulation, and structural evaluation using ANSYS and other simulation tools.

Product and component design: Support the development of prototypes and mechanical parts through parametric and surface modeling.

Architectural and civil design: Draft floor plans, elevation views, and infrastructure layouts for buildings, bridges, and roadways.

Interdisciplinary learning platform: Facilitate collaborative projects involving civil, mechanical, and electrical engineering design principles.

Skill development and industry readiness: Provide hands-on training and certification preparation for students entering design-centric roles in industry.



Transportation Engineering Lab

The Transportation Engineering Laboratory is a specialized facility dedicated to the study, analysis, and evaluation of materials and systems used in transportation infrastructure. This lab is equipped with advanced instruments for testing pavement materials such as bitumen, aggregates, and asphalt mixes, and for analyzing the performance of road surfaces under varying conditions. Key equipment includes the Marshall Stability Test apparatus, Los Angeles Abrasion Testing Machine, Bitumen Penetration and Ductility Test setups, and CBR (California Bearing Ratio) Testing equipment. The laboratory provides essential practical exposure for students and researchers, enabling them to understand the behavior of transportation materials, evaluate pavement design parameters, and conduct quality control tests as per IRC and ASTM standards. It serves as a crucial resource for the planning, design, and maintenance of efficient and sustainable transportation systems.

Key Functionalities of Transportation Lab:

Bitumen testing: Determine the quality and grade of bitumen through tests like penetration, ductility, softening point, and viscosity.

Pavement material evaluation: Assess the stability and flow values of bituminous mixes using the Marshall Stability Test.

Subgrade strength analysis: Conduct CBR (California Bearing Ratio) tests to determine the load-bearing capacity of subgrade soils for pavement design.

Mix design and optimization: Develop and evaluate bituminous and concrete mix designs for various pavement applications.

Quality control and standard compliance: Perform material testing as per IRC, MORTH, ASTM, and IS specifications to ensure construction quality.

Educational and research support: Enable hands-on learning, project work, and research in highway materials, pavement design, and transportation system analysis.

Rebound Hammer Test

Bitumen Testing Machines

Upcoming Drone Technology Lab

An upcoming **Drone Technology Laboratory** is being established at NITTTR Bhopal with the vision to advance research, training, and innovation in the rapidly growing field of unmanned aerial systems (UAS). This state-of-the-art facility will be equipped with modern drones, flight simulators, and supporting hardware and software for design, programming, navigation, and real-time data acquisition. The lab aims to provide hands-on experience in drone assembly, flight control, aerial mapping, and data analysis for applications across civil engineering, agriculture, surveillance, disaster management, and smart infrastructure monitoring. By integrating drone technology into technical education and research, the lab will empower students and professionals with cutting-edge skills aligned with Industry 4.0 and future-ready technologies.

In addition to these advanced labs, the department offers a robust academic portfolio to nurture the next generation of engineers, researchers, and technologists

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Product, Design and Validation Lab:

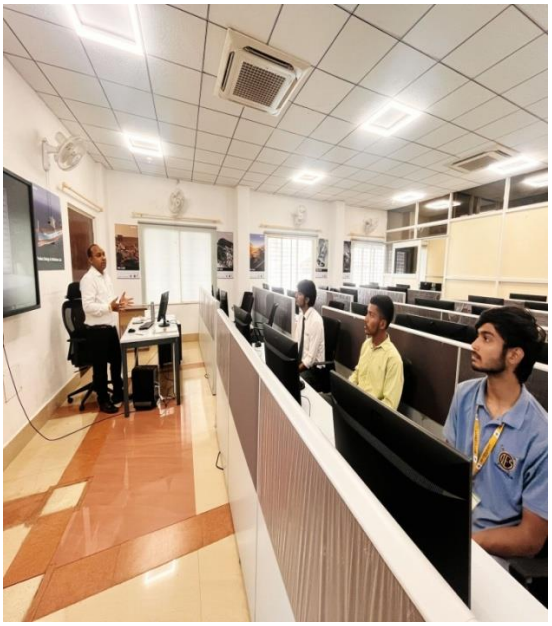
The Product Design and Validation Lab at NITTTR Bhopal is a key facility for developing and testing new products. It provides resources and expertise for various stages of product development, including concept generation, prototyping, and rigorous testing. It allows students to gain hands-on experience in the process of bringing ideas to market.

Key Functionality

- Design Concept as well as complete parametric model
- Design Interoperability
- Design Validation
- Design for Manufacturing

Facility

- High end CAD work stations
- NX Academic Core+CAD
- NX Academic CAE+CAM
- NX Sheet Metal
- NX Wire Harness & Routing



Simulation, Optimization and Testing Lab

The Simulation & Optimization Lab focuses on modeling real-world systems using simulation techniques and improving their performance through optimization methods. The lab also feature has equipment for testing and validating various components and systems.

Key Functionality

- Finite Element Modeling
- Computational Fluid Dynamics
- Thermal Analysis
- Acoustics Simulation
- Battery Simulation
- Inter Combustion Engine System Simulation
- Model Based Systems Engineering

Facility

- High end CAD work stations
- Simcenter 3D, STAR-CCM, Simcenter Amesim, NX Nastran, HEEDS & Test Lab