Laboratories

1) **Mechanical Engineering Graphics,**
2) **Mechanical Engineering Materials,**
3) **Heat Transfer,**
4) **Fluid Mechanics,**
5) **Instrumentation and Measurements,**
6) **Manufacturing Processes,**
7) **Robotics, Mechatronics and Digitization Lab**
8) **Dynamics Systems and Control.**
9) **Fundamentals of Renewable Energy Lab**
   A. **Solar Energy**
      Mini solar cell kits facilitate the study of photovoltaic energy conversion, enabling students to measure power output, analyze system efficiency, and understand the impact of environmental factors on solar power generation.
   B. **Wind Energy**
      Miniature wind turbine modules bring the principles of wind power to life. Students experiment with different blade designs and configurations, exploring the relationship between wind speed, turbine rotation, and energy output.
   C. **Solar Thermal Energy**
      Dedicated kits illuminate the process of converting sunlight into heat. Through practical exercises, students gain insights into solar collectors, heat transfer mechanisms, and thermal storage systems.
   D. **Energy Storage**
      Battery storage kits provide a platform to investigate the crucial role of energy storage in renewable energy systems. Students explore battery charging and discharging characteristics, evaluate different battery types, and consider the importance of energy management strategies

10) **Solar Energy Lab**
   A. The Solar Energy Lab offers students a comprehensive platform for investigating the principles and applications of solar photovoltaic (PV) technology. Through hands-on experiments and practical exercises, students delve into the intricacies of:
   B. **Off-Grid PV Systems:** This section of the lab explores self-contained solar power solutions for remote or isolated locations. Students gain valuable experience in designing, installing, and managing off-grid PV systems, including the sizing and configuration of solar panels, battery storage, and power inverters.
   C. **Grid-Tied PV Systems:** This segment of the lab focuses on connecting solar power systems to the existing electrical grid. Students investigate the challenges and opportunities associated with grid integration, including net metering, grid synchronization, and safety protocols.
   D. **Solar Tracking PV Systems:** This innovative area of the lab showcases the benefits of using solar trackers to maximize energy capture. Students gain practical knowledge about different tracking mechanisms, control systems, and the impact of solar tracking on overall system efficiency.

11) **Wind Energy Lab**

A. **Small-Scale Wind Turbines**
   A variety of miniature wind turbines, including horizontal-axis and vertical-axis models, demonstrate the fundamental principles of wind energy conversion.
B. **Weather Station**
   A weather station enables students to monitor real-time environmental conditions such as wind speed, direction, temperature, and humidity, providing context for their turbine experiments.
C. **Blower**
   A controlled blower allows students to simulate different wind speeds, facilitating the measurement of generated power and efficiency across various turbine designs.
D. **Motors and Generators**
   A collection of motors and generators supports experiments related to emulating wind turbine operation, energy conversion, and system control.

12) **Computer-based Laboratories**: to conduct simulation-based analysis and interpretation in various Electrical Engineering disciplines.
13) **Circuits and Electronics Laboratory**: to expose students to various circuit design, measurement, and testing techniques, and explore the characteristics of electronic components and circuits.
14) **Digital Systems Laboratory**: to design and verify basic digital logic circuits, practice assembly programming techniques and debugging approaches, and perform peripheral interfacing of microprocessors or microcontrollers.
15) **Electric Machines Laboratory**: to test and verify DC and AC machines and explore their characteristics for different operation modes.
16) **Control Systems Laboratory**: to design, implement, and evaluate computer-aided control experiments and experience a diverse collection of systems using control principles.
17) **Communication Systems Laboratory**: to evaluate the performance of various analog and digital communication systems through the design and analysis of their corresponding transmission and reception blocks.
18) **Power Systems Laboratory (Loading…):** an A-to-Z state-of-the-art educational and research Laboratory that spans various electric power and renewable energy disciplines.
19) **Geotechnical Engineering Laboratory** is utilized to evaluate the physical, mechanical, and hydraulic properties of soils through a suite of standardized testing procedures. The lab supports analyses such as shear strength evaluation via direct shear and triaxial compression tests, consolidation testing to assess soil settlement under load, and permeability testing to determine hydraulic conductivity. Key index properties, including moisture content (measured via the oven-drying method), specific gravity, and Atterberg limits (liquid limit, plastic limit, and plasticity index) can be conducted in the lab. Grain size distribution analysis, compaction characteristics via Proctor tests (both standard and modified), and in-situ density determination through the sand-cone method are integral to the lab's capabilities.
20) **Engineering Materials Laboratory**: The Engineering Materials Laboratory is used for evaluating the properties and performance of construction materials. Key tests include the slump test to assess fresh concrete workability, compressive strength test for determining strength of hardened concrete, and split tensile strength test to measure indirect tensile resistance. The direct tensile strength test evaluates materials under pure tension, while mortar tests analyze consistency, setting time, and strength of cement-based mixtures. Additionally, sieve analysis test determines particle size distribution of aggregates, ensuring proper gradation for optimal material performance
21) **Surveying Laboratory**: The tests usually covered include distance measurement by taping and ranging, determining elevations using levelling, horizontal and vertical angles measurement, and total station.

22) **Fluid Mechanics Laboratory**: The tests usually covered include determination of the friction factor for the pipes, determination of the coefficient of discharge, contraction and velocity of an orifice, verification of Bernoulli's theorem, determination of critical Reynolds number for a pipe flow, determination of the minor losses due to sudden enlargement, sudden contraction and bends, determination of the velocity distribution in an open channel and to determine the energy and momentum correction factors
23) **Environmental Engineering Laboratory**: This is a new lab established to study and analyze various environmental parameters, including water and air quality. The lab is equipped with advanced instruments such as spectrophotometers, dissolved oxygen meters, turbidimeters, and gas chromatographs, to enable students conduct experiments on wastewater treatment, pollution control, and environmental monitoring. The environmental lab helps students testing of biochemical oxygen demand (BOD), chemical oxygen demand (COD), heavy metal contamination, and air pollutant levels.
24) **Asphalt Laboratory**: This lab equipped with testing facilities, to conduct penetration and viscosity tests for bitumen consistency, dynamic shear rheometer (DSR) to measure viscoelastic properties of bitumen, and Marshall Stability tests to determine the strength and deformation resistance of asphalt mixtures. For aggregates, the lab performs analyses, including sieve grading, specific gravity, and abrasion resistance assessments. Additionally, the maximum theoretical specific gravity (G_{mm}) test is utilized to optimize mixture compaction and void analysis.

Lab Safety Guidelines

The following information is intended to make you better informed; however, before working in the laboratory area, instructors instruct their students in laboratory safety procedures.

Wearing safety glasses or goggles is mandatory in laboratories where they are needed.

- Be aware of the locations of safety showers, eye washes, fire extinguishers, telephones, and material safety data sheets so you can use them when needed.
- Report all chemical spills immediately to the lab instructor.
- Broken glass and all waste chemicals must be disposed of in the authorized containers.
- Wear lab coats when handling chemicals.
- Always wear shoes in the laboratory, and do not wear sandals or perforated shoes.
- Always wear long pants, and do not wear shorts in the laboratory area.
- If you discover a fire or fire-related emergency such as abnormal heating of material, hazardous gas leaks, hazardous material or flammable liquid spill, smoke, or odor of burning, immediately activate the building fire alarm system and notify the fire department.
- As part of your introduction to the laboratory, before starting experiments in the department labs, students must review the Laboratory Safety Manual with his/her instructor, be familiar with its contents, and keep it handy for reference