

The department of mechanical engineering Laboratories

The laboratories used by the ME Department are in the Laboratories Buildings (Buildings-11 and 12). The laboratories have adequate equipment for carrying out experimental work for courses, senior projects, and community service. The laboratories are well maintained and regularly upgraded. The

laboratories thus adequately support the curriculum delivery. These include the following laboratories:

- A. Engineering Workshop
- B. Mechanics of materials and engineering materials laboratory
- C. Mechanical of machines and mechanical vibrations laboratory
- D. Fluid mechanics and hydraulic laboratory
- E. Refrigeration and air condition laboratory
- F. Energy laboratory.
- G. Heat transfer, thermodynamics, and combustion laboratory

A. Engineering Workshop

The ME workshop is equipped with machines and apparatus for training the students in the fields of casting, metal forming, and machining processes, see Fig 1.

Basic workshop, equipped with:

- Filing, sawing, and hand working facilities
- Sheet metal work
- Drilling machines
- Turning machines
- Shaping and milling machines
- Grinding machines
- Rolling and wire drawing
- Metal forming
- Casting
- Welding

This Engineering Workshop covers the experimental work associated with the production technique and workshops (ENG 202), introduction to engineering 1 (ENG205), introduction to engineering 2 (ENG213), graduation project 1 (ME 493) and graduation project 2 (ME 494) courses.



Figure 1. Engineering Workshop Facilities.

B. Mechanics of materials and engineering materials laboratory

This lab actively contributes to teaching activities in the ME Department. It enables faculty and students to provide tests such as tension, compression, shear, torsion, buckling, hardness, bending, creep, deep drawing, impact, fatigue and metallurgical observations, and is used in determining the mechanical properties and characterization of materials and testing for students. It provides educational facilities at different levels to undergraduate students. The lab is used in the graduation projects related to mechanical testing of materials and the graduation projects related to material science. The mechanics of materials and engineering materials laboratory which covers the experimental work associated with engineering materials (ME 201), mechanics of materials (ME 213), graduation project 1 (ME 493) and graduation project 2 (ME 494) courses, Figure 2. The laboratory's equipment includes:

- Universal testing machine (20 KN)

- Torsion testing machine (200 Nm)
- Fatigue testing machine
- Creep testing machine
- Buckling apparatus
- Strain gauge training system applying to tensile, torsion and bending tests
- Stress and strain analysis on a thin-walled cylinder unit
- Buckling Apparatus
- Pendulum impact tester
- Units to determine the elastic line and deformation of the frame
- Polari scope
- Double disc Grinding/Polishing Machine
- Specimen Cutting Machine
- Materials Microscope



Figure 2 .Mechanical of Materials and Engineering materials Lab.

C. Mechanics of machines and mechanical vibrations Laboratory

The Mechanical Systems and Vibration Lab is used to perform the experiments of the mechanics of machines and mechanical vibrations courses and analyzing the data to obtain the characteristics of various types of mechanisms of machines as well as the vibration phenomena and effects on sensitive parts and how to control the vibration and its damping, see Figure 3. The lab covers the experimental work associated with the mechanical vibrations (ME314), mechanics of machines (ME212), graduation project 1 (ME 493) and graduation project 2 (ME 494) courses. The laboratory's equipment includes:

- Crank and connection rod apparatus
- Four bar chain
- Slotted link apparatus
- Gear trains model
- Flywheel apparatus
- Gyroscope
- Governor
- Universal vibration tester
- Free and damped torsional vibration apparatus
- Whitworth quick return apparatus
- Compound pendulum apparatus
- Bifilar/trifler suspension apparatus
- Static and dynamic balancing
- Critical speed investigation apparatus
- Whirling shaft apparatus
- Bending elasticity in rotors



Figure 3. Mechanical Systems and Vibration Lab.

D. Fluid Mechanics and Hydraulic machines Laboratory

The Fluid Mechanics and Hydraulic laboratory provides a “hands on” environment that is crucial for developing students understanding of theoretical concepts. The laboratory contains equipment for the measurement of various fluid properties and flow characteristics. Facilities are available for investigating the fundamentals of fluid statics as well as kinematics and kinetics of fluid flow to enhance the hands-on experience of our students. The lab is equipped with test rigs for experiments pertinent to fluid mechanics, pumping machinery, and hydraulic turbines, see Figure 4.

The pumping machinery and hydraulic turbines devices aim to give students hands-on experience at conducting experiments and analyzing the data to obtain the performance characteristics of various types of pumps, fans and compressors. Many experiments are conducted in the lab such as:

- Performance characteristics of a centrifugal radial flow pump
- Effect of impeller size on the performance of a centrifugal pump
- Performance characteristics of an axial flow pump
- Performance of centrifugal fans
- Performance characteristics of a jet pump
- Performance characteristics of a multi-stage centrifugal compressor

The Fluid Mechanics and Hydraulic lab covers the experimental work associated with the ME fluids mechanics 1 (ME231), turbomachinery 1 (ME332), graduation project 1 (ME493), graduation project 2 (ME494) and pipelines engineering (ME452) courses. The lab has an essential and effective role enabling mechanical engineering students to gain educational understanding and experimental information in the field of fluid mechanics and hydraulics, turbomachines and projects. The laboratory's equipment includes:

- Hydrostatics and fluid properties bench
- Hydrostatic pressure apparatus
- Free and forced vortices apparatus
- Dead weight pressure gauge calibrator apparatus
- Orifice discharge apparatus
- Air flow studies unit
- Osborne Reynolds's demonstration unit
- Bernoulli's theorem demonstration unit
- Flow meter measurement apparatus
- Energy loss in bends and fittings

- Hydrogen bubble flow visualization system
- Cavitation demonstration apparatus
- Flow over weirs
- Flow channel
- Pipe surge and water hammer apparatus
- Pipe network system apparatus
- Centrifugal pump characteristics
- Series and parallel pumps demonstration unit
- Gear pump demonstration unit
- Impact of a jet apparatus
- Turbine service unit
- Pelton wheel turbine apparatus (impulse type)
- Francis turbine apparatus (radial flow type)
- Plunger pump demonstration unit
- Fluid friction measurements unit
- Metacentric height unit
- Fluid statics and manometric unit
- Pascal's apparatus



Figure 4. Fluid Mechanics and Hydraulic Lab.

E. Refrigeration and Air Conditioning Laboratory

The Refrigeration and Air Conditioning laboratory is equipped with a wide variety of instructional facilities in the area of refrigeration and air-conditioning. The laboratory contains modern instruments which are used to train students in the practical aspect of the refrigeration and air conditioning, see Figure 5. This lab provides students opportunity to develop an overall background in the components of Refrigeration and Air-Conditioning systems.

- Determination of the coefficient of performance, cooling and heating loads, rates of humidification and dehumidification of Refrigeration and Air-Conditioning systems.
- Construction and systems evaluation of graduate projects.
- Possibilities of organizing short training courses in Refrigeration and Air-Conditioning systems design, operation, performance evaluation and fault simulation.

The Refrigeration and Air Conditioning laboratory covers the experimental work associated with thermodynamic 1 (ME 221), Refrigeration and Air Conditioning (ME 424), graduation project 1 (ME 493) and graduation project 2 (ME 494) courses.

The laboratory's equipment's include:

- Simple compression refrigeration circuit
- Refrigeration circuit with variable load
- Absorption refrigeration system
- Changes of state in the refrigeration circuit
- Refrigeration system with refrigeration and freezing chamber
- Refrigeration chamber and defrosting methods
- Heat exchangers in the refrigeration circuit
- Conditioning of room air unit
- Vehicle air conditioning unit
- Forced draft cooling tower unit
- Double-Pipe, concentric tube heat exchanger test unit
- Cross flow heat exchanger
- Combined convection and radiation heat transfer unit



Figure 5. Refrigeration and Air Conditioning Lab.

F. Energy Laboratory

The Energy Laboratory provides students opportunity to develop an overall background in the thermal and electrical applications of solar energy for domestic and industrial uses, see Figure 6. It also enables students to study and practice:

- Determination of the feasibility and efficiency of solar engineering systems, like water and air heating, water desalination, solar ovens, solar concentrators for industrial processes heat and power generation and solar energy storage systems.
- Construction and systems evaluation of graduate projects.
- Possibilities of organizing short training courses engineering solar systems design, operation and performance evaluation.

The Energy laboratory covers the experimental work associated with the thermodynamic 1 (ME 221), heat transfer (ME 332), thermodynamic 2 (ME 323), Power and Desalination plants (ME425), Renewable energy systems (ME453), graduation project 1 (ME493) and graduation project 2 (ME 494) courses. The laboratory's equipment includes:

- Solar module measurement
- Stand-alone and/or grid-connected Photovoltaic
- Computer- controlled subsonic wind tunnel
- Vertical –axis small-scale lab wind turbine facility



Figure 6. Energy Lab.

G. Heat Transfer, Thermodynamics and Combustion Laboratory

This lab provides students an overall background in the thermal applications of thermodynamics, heat transfer, and heat engines for industrial uses. This laboratory covers the experimental work associated with the thermodynamic 1 (ME221), heat transfer (ME322), thermodynamic 2 (ME323), Power and Desalination plants (ME425), graduation project 1 (ME 493) and graduation project 2 (ME494) courses. The laboratory's equipment includes (figure 7):

- Temperature measurement and calibration unit
- Pressure measurement and calibration unit
- Water to air heat exchanger unit
- Cross flow heat exchanger
- Saturation pressure and throttling calorimeter
- Expansion processes of a perfect gas apparatus
- Basic heat transfer teaching unit
- Combined convection and radiation test unit
- Energy balance apparatus
- Mechanical equivalent of heat

- Steam motor and energy conversion apparatus



Figure 7. Heat Transfer, Thermodynamics and Combustion Lab.