University of the Philippines
LOS BAÑOS


UNIVERSITY OF THE PHILIPPINES LOS BAÑOS
CEAT

# College of Engineering and Agro-Industrial Technology

# COLLEGE OF ENGINEERING AND AGRO-INDUSTRIAL TECHNOLOGY

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The College of Engineering and Agro-Industrial Technology (CEAT) traces its roots to the former Department of Agricultural Engineering, which was created in 1912 as one of the departments of the College of Agriculture. On June 24, 1976, the department became the Institute of Agricultural Engineering and Technology. It was elevated to a college on February 24, 1983. The elevation of the institute to a college gave rise to the establishment of the Chemical Engineering Department and creation of the Engineering Science Department. In all these years, CEAT pursues the university goals of providing leadership in agro-industrial engineering for countryside development.

Today, the College offers undergraduate curricular programs leading to the Bachelor of Science degrees in Agricultural and Biosystems Engineering (BSABE), Chemical Engineering (BSChE), Civil Engineering (BSCE), Electrical Engineering (BSEE), Industrial Engineering (BSIE), Mechanical Engineering (BSME) and Materials Engineering (BSMatE). The College also offers post-graduate programs in the following fields: Master of Science in Agricultural Engineering and Chemical Engineering and PhD in Agricultural Engineering and PhD by Research in Agricultural Engineering and PhD by Research in Chemical Engineering.

The University of the Philippines Los Baños, with its national and regional mandates for excellence in engineering education; its commitment to rural agro-industrial development and its proven strengths in graduate and undergraduate instruction and research, is in a unique position to complement the crop of graduates of other institutions for the agro-industrial development needs of the country.

The CEAT aims to: 1) produce quality engineering graduates needed for agricultural and industrial development of the country; 2) advance the frontier of knowledge in engineering and generate technologies in support of the agro-industrial thrusts of the country; and 3) promote the utilization of useful technologies by proper clientele.

## UNDERGRADUATE PROGRAMS

### Bachelor of Science in Agricultural and Biosystems Engineering

The undergraduate program provides a comprehensive education that integrates engineering principles with applied biological, environmental, and agricultural sciences. The four-year curriculum consisting of 161 units, including 9 specialization courses, adheres to the rigorous standards set by both the Commission on Higher Education and the Table of Specifications for Agricultural and Biosystems Engineers Licensure Examination prescribed by the Professional Regulations Commission. Through a combination of theoretical knowledge and practical skills, graduates are prepared to make meaningful contributions to their industries and communities while upholding the highest standards of ethical engineering practice.

Students have the opportunity to choose from five distinct specializations, each tailored to address specific industry needs and challenges. The Bachelor of Science in Agricultural and Biosystems Engineering offers specializations in Agricultural, Food and Bioprocess Engineering (AFBE); Agribiosystems Machinery and Power Engineering (AMPE); Agrometeorology, Bio-structures, and Environment Engineering (ABSEE); Land and Water Resources Engineering (LWRE); and Forest Products Engineering (FPE).

Graduates of the AFBE specialization are equipped to develop and enhance food, feed, and fiber processing and distribution systems. Those specializing in AMPE delve into agricultural machinery, farm power, and mechanization. The ABSEE specialization focuses on optimizing crop yield across various weather conditions and improving production efficiency through controlled environment technologies. LWRE majors are trained in smart irrigation techniques, hydrologic modeling, and integrated planning for soil and water conservation. Lastly, FPE majors learn to sustainably utilize forest products resources as alternative engineering materials for agricultural structures, as well as, for heat and power generation and conversion.

### Bachelor of Science in Chemical Engineering

The graduates of this curriculum are expected to meet the technical manpower requirements of the newly emerging agri-based industries and traditional chemical process industries, specifically in the area of bioprocess engineering and chemical process engineering. Chemical engineers with some understanding of bioprocesses are needed to scale up production from laboratory to pilot into the industrial level. In the long run, local processing of rawmaterials into consumer and industrial products should help raise rural income, generate foreign exchange and protect the Philippine economy from adverse external trade conditions.

Students in this program may take the general curriculum or the major in Sugar Technology or Pulp and Paper Technology options. These curricula require 15 units of GE Core courses, 9 units of GE Elective courses, 3 units of a legislated course, 46 units of foundation courses in basic sciences (Mathematics, Physics and Chemistry), and 20 units of general engineering courses.

The general curriculum includes 54 units of Chemical Engineering courses and 6 units of cognate courses which may be chosen from the following fields: statistical modeling, forest products and paper science, management, scientific and technical communication, environmental chemistry, biotechnology, food microbiology, economics, sugar engineering, food engineering, dairy technology, entrepreneurship, and technopreneurship. In addition, a 3-unit internship course provides on-the-job training and experience for graduating students. Finally, 6 units are devoted to either of the following 3 options: undergraduate thesis, innovationeering or engineering industry research, to provide the student experience in integrating and applying his technical knowledge in solving industrial processing problems and generating new technologies relevant to

agri-based industries.

**Bachelor of Science in Chemical Engineering, major in Sugar Technology**

The graduates of this curriculum are expected to meet the technical manpower requirements of the sugar industry and allied industries. With solid background in both chemical engineering and sugar technology, it is envisioned that this program will develop graduates who possess competency and proper perspective to meet the changing needs of the sugar industry and related agri-based industries.

This curriculum includes 39 units of Chemical Engineering courses and 22 units of Sugar Technology courses. A 3-unit internship course provides on-the-job training and experience for graduating students. Finally, 6 units are devoted to either of the following 3 options: undergraduate thesis, innovationeering or engineering industry research, to provide the student experience in integrating and applying his technical knowledge in solving problems in sugar factory operations and generating new technologies relevant to the sugar industry.

**Bachelor of Science in Chemical Engineering, major in Pulp and Paper Technology**

The graduates of this curriculum who are sufficiently trained in the science and technology of pulp and paper making are expected to meet the professional manpower requirements of the pulp and paper industry. With strong backgrounds in both chemical engineering and in pulp and paper science and technology, it is expected that this program will produce globally competitive professionals equipped with the knowledge of the process involved in converting wood and fibers, and recycling the same, into paper.

This curriculum includes 39 units of Chemical Engineering courses and 23 units of specialized courses in pulp and paper technology. A 3-unit internship course provides on-the-job training and experience for graduating students. Finally, 6 units are devoted to either of the following 3 options: undergraduate thesis, innovationeering or engineering industry research, to provide the student experience in integrating and applying his technical knowledge in solving problems in pulp and paper processing operations and generating new technologies relevant to the pulp and paper industry.

**Bachelor of Science in Civil Engineering**

One of the most important aspects of rural development in the Philippines is the continuing need for infrastructures for transportation, communication, commerce, education, human settlements, energy development and agriculture. In the age of modern technology and interdependence of people and institutions, civil engineers constitute a specialized group of trained manpower whose expertise is indispensable for the design and construction of infrastructures for public and private use.

The Southern Tagalog Region, in particular, is an emerging agro-industrial center with a high-projected need for irrigation and drainage, roads, bridges, manufacturing plants, agro-processing facilities, warehouses and port development.

There are parallel high growth needs in residential homes, business offices, water supply systems and waste-disposal facilities. In the total picture, competent civil engineering graduates with other professionals are needed to effect the development of structural systems that are safe, economical and efficient. The UPLB seeks to help upgrade in the long run, the quality of civil engineering education in the country, particularly in the Southern Tagalog Region.

**Bachelor of Science in Electrical Engineering**

This curricular program offers an excellent opportunity for the students to acquire solid academic preparations in electrical and electronic circuit theory and analysis. Graduates of the program are expected to be fully equipped and able to enhance the level of their competencies as they chart their professional careers in the development mainstreams, particularly in power, electronic and computer engineering including equipment/instrument design.

This curricular program was conceived in response to the dire need for well-trained electrical and electronic engineers in all sectors of development, both the local and global scales. In the Philippines, graduates of electrical engineering are key players as the country modernizes in agriculture systems and accelerates in rural-urban and industrial base for the 21st century.

Each student can specialize in one or more of the following fields: (a) power engineering, (b) electronics engineering and (c) computer engineering. Moreover, the student must choose as part of their specialization course among: undergraduate thesis, engineering industry research or innnovationeering.

**Bachelor of Science in Industrial Engineering**

This curricular program aims to enable its students to have the competence to plan, design, install and evaluate integrated systems of personnel, materials, equipment, energy and information in ways that reduce costs and increase system efficiency and effectiveness. Through the program, the students are provided technical competencies for industrial systems analysis, design, and management.

The BSIE program meets the minimum standards and other requirements set by the Commission on Higher Education. Graduates of the program are expected to apply their knowledge and skills for the industrial development needs of the Philippines.

The academic program is distinct from other curricula in industrial engineering in that it requires the students to conduct and document a thesis research or practicum study before they graduate.

The UPLB BSIE program is highly recommended for high school graduates who are good in mathematics, physics and chemistry and have keen interests in industrial systems processes, organization and management.

**Bachelor of Science in Mechanical Engineering**

Mechanical engineering is one of the broadest and most versatile of the engineering professions. It is concerned with the responsible development and use of products, processes, and power, whether at the molecular scale or at the scale of large complex systems. Mechanical engineering principles and skills are

needed at some stage during the conception, design, development, and manufacture of every human-made object with moving parts such as machinery, engines, and structures that are used in industrial, biomedical, instrumentation, and transportation systems.

Graduates of the BS Mechanical Engineering program must be able to apply fundamental knowledge to solve mechanical engineering problems, design a component, system or process to meet desired needs within realistic constraints, understand professional and ethical responsibility, and create an impact on a global economic, environmental and societal context through mechanical engineering solutions. Like their other engineering counterparts, BSME graduates fill the workforce needs of the fast-growing industrial, science, and technology parks, the existing, and emerging industries in the region and in the country.

UPLB BSME graduates are guided by the University's mission and vision to provide knowledge and skills that shape their minds to pursue further studies and excel in opportunities that contribute to the nation's engineering technology field. Graduates of this program are envisioned to be leaders in areas related to the operation, maintenance, and management of industries or design, machinery, processes, mechanical works in manufacturing, agro-industries and power plants, ventilating and air-conditioning systems (VAC), and research leading to national development.

The BS Mechanical Engineering program includes six (6) units of electives with a unique variety of course options such as Introduction to Biomechanical Engineering, Introduction to Mechatronics and Robotics, and Design of Renewable Energy Systems. Aside from these electives, graduating students are not only bound to the thesis option but are also allowed to select Engineering Industry Research or Innovationeering as its equivalents which are rarely offered in other universities.

**Bachelor of Science in Materials Engineering**

Materials engineering is a field of engineering that has been central to human civilization and industrialization. It builds on a comprehensive understanding of a material's structure-property relationships to create and tailor it for an intended application. Materials engineers engage in creating new materials, improving existing ones, and optimizing manufacturing processes to enhance performance, durability, and sustainability across sectors such as aerospace, automotive, construction, electronics, energy, and healthcare.

The 4-year BS Materials Engineering curriculum offers a comprehensive and interdisciplinary study of the interrelationships among the structure, property, processing, and performance of materials. The curriculum includes six units of electives, allowing for specialization in specific material classes or processes. The program culminates in a six-unit capstone course, where students can choose among an undergraduate thesis, innovationeering, or engineering industry research.

Graduates of the BS Materials Engineering program are expected to apply their knowledge and skills in the development of materials for applications that address both national development priorities and global economic and environmental concerns. They are equipped to collaborate effectively within interdisciplinary teams, guided by a strong sense of professional, ethical, and social responsibility. Furthermore, graduates are expected to continually advance their expertise, contributing to technological advancements and innovations across various industries.

**BACHELOR OF SCIENCE IN AGRICULTURAL AND BIOSYSTEMS ENGINEERING**

Special UPLB UC Meeting 21-22 May 2018; President's Approval 28 August 2019

| *First Semester* | *Units* | *Second Semester* | *Units* |
|---|---|---|---|
| | | *FIRST YEAR* | |
| ABE 30, Introduction to ABE | 1 | AGRI 21, Introduction to Animal Science | 3 |
| AGRI 31, Fundamentals of Crop Science I | 3 | CHEM 18, University Chemistry | 3 |
| ENSC 10.1, Engineering Graphics Laboratory | 2 | CHEM 18.1, University Chemistry Laboratory | 2 |
| MATH 27, Analytical Geometry and Calculus II | 3 | AGRI 32, Fundamentals of Crop Science II | 3 |
| PHYS 51, Elements of Physics | 4 | ENSC 11, Statics of Rigid Bodies | 3 |
| PHYS 51.1, Elements of Physics Laboratory | 1 | MATH 28, Analytical Geometry and Calculus III | 3 |
| KAS1/HIST1, Kasaysayan ng Pilipinas/Philippine History | 3 | NSTP 2, National Service Training Program II | (3) |
| PI 10, Life and Works of Rizal | 3 | HK 12 or 13, Human Kinetics Activities/ Advanced Human Kinetics Activities | (2) |
| NSTP 1, National Service Training Program I | (3) | GE Elective | 3 |
| HK 11, Wellness and Basic Injury Management | (2) | | 20 |
| | 20 | | |
| | | *SECOND YEAR* | |
| ABE 43, Engineering Shop | 3 | ABE 52, Agricultural Structures I | 3 |
| ABE 48, Fundamentals of Surveying | 3 | ABE 53, Machine Design for Bio-production Systems I | 4 |
| ENSC 12, Dynamics of Rigid Bodies | 3 | ABE 56, Engineering Properties of AB Materials | 3 |
| ENSC 13, Strength of Materials | 3 | ABE 57, Field Hydrology | 3 |
| ENSC 14a, Thermodynamics and Heat Transfer | 5 | ENSC 16, Fluid Mechanics | 3 |
| AGRI 51, Principles of Soil Science | 3 | GE Elective | 3 |
| HK 12 or 13, Human Kinetics Activities/ Advanced Human Kinetics Activities | (2) | HK 12 or 13, Human Kinetics Activities/ Advanced Human Kinetics Activities | (2) |
| | 20 | | 19 |
| | | *MIDYEAR* | |
| ABE 198, Internship | 3 | | |
| | | *THIRD YEAR* | |
| ABE 62, Environmental Control Engineering | 3 | ABE 74, Machinery for Bioproduction Systems, Management and Technopreneurship | 4 |
| ABE 63, Agricultural and Biosystems Power Engineering | 4 | ABE 79, ABE Laws, Specifications, Contracts and Ethics | 1 |
| ABE 65, Quantitative Approaches in ABE | 3 | ABE 77, Soil and Water Conservation Engineering | 3 |
| ABE 66, Agricultural Processing I | 3 | COMM 10, Critical Perspective in Communications | 3 |
| ABE 67, Irrigation and Drainage Engineering | 3 | STAT 101, Statistical Methods | 3 |
| FPPS 183, Engineering Economic Analysis | 3 | Elective | 3 |
| | 19 | Specialization Course | 3 |
| | | | 20 |
| | | *FOURTH YEAR* | |
| ABE 80, Computer-Aided Solutions in ABE | 3 | ABE 83, Electrical System Design for Agricultural and Biosystems Structures | 3 |
| ABE 88, Aquaculture Engineering I | 3 | ETHICS 1, Ethics and Moral Reasoning in Everyday Life | 3 |
| GE Elective | 3 | ARTS 1, Critical Perspective in the Arts | 3 |
| ENG 10, Writing of Scientific Papers | 3 | STS 1, Science, Technology and Society | 3 |
| Elective | 3 | Specialization Course | 3 |
| Specialization Course | 3 | ABE 199, Undergraduate Seminar | 1 |
| ABE 200/b/c, Undergraduate Thesis/ Innovationeering/ Engineering Industry Research | 3 | ABE 200/b/c, Undergraduate Thesis/ Innovationeering/ Engineering Industry Research | 3 |
| | 21 | | 19 |

**TOTAL NUMBER OF UNITS 161**

**BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING**

(General Curriculum)

Special UPLB UC Meeting 21-22 May 2018/; President's Approval 28 August 2019

| ***First Semester*** | ***Units*** | ***Second Semester*** | ***Units*** |
|---|---|---|---|
| | | *FIRST YEAR* | |
| ChE 10, Introduction to Chem. Eng. Profession | 1 | CHEM 32, Quantitative Inorganic Analysis | 3 |
| CHEM 18, University Chemistry | 3 | CHEM 32.1, Quantitative Inorganic Analysis Laboratory | 2 |
| CHEM 18.1, University Chemistry Laboratory | 2 | CHEM 40, Basic Organic Chemistry | 4 |
| MATH 27, Analytical Geometry & Calculus II | 3 | CHEM 40.1, Basic Organic Chemistry Laboratory | 1 |
| PHYS 51, Elements of Physics | 4 | MATH 28, Analytical Geometry & Calculus III | 3 |
| PHYS 51.1, Elements of Physics Laboratory | 1 | GE (Elective) | 3 |
| MCB 11, Biology and Applications of Microorganisms | 3 | ARTS 1, Critical Perspectives in the Arts | 3 |
| PI 10, The Life and Works of Jose Rizal | 3 | STS 1, Science, Technology and Society | 3 |
| HK 11, Wellness and Basic Injury Management | (2) | HK 12, Human Kinetics Activities | (2) |
| NSTP 1, National Service Training Program I | (3) | NSTP 2, National Service Training Program | (3) |
| | 20 | | 22 |
| | | *SECOND YEAR* | |
| ChE 30, Fundamentals of Chemical Engineering | 4 | ENSC 26, Computer Applications in Engineering | 3 |
| ENSC 10.1, Engineering Graphics Laboratory | 2 | ChE 32, Industrial Stoichiometry | 3 |
| ENSC 11, Statics of Rigid Bodies | 3 | ENSC 12, Dynamics of Rigid Bodies | 3 |
| EE 1, Basic Electrical Engineering | 3 | ENSC 21, Mathematical Methods in Engineering | 3 |
| CHEM 111, Physical Chemistry I | 3 | CHEM 111.1, Physical Chemistry I Laboratory | 2 |
| CHEM 160, Introductory Biochemistry | 3 | CHEM 112, Physical Chemistry II | 3 |
| KAS 1/HIST 1, Kasaysayan ng Pilipinas/Philippine History | 3 | GE (Elective) | 3 |
| HK12/HK13, Human Kinetics Activities/ Advanced Human Kinetics Activities | (2) | HK12/HK13, Human Kinetics Activities/ Advanced Human Kinetics Activities | (2) |
| | 21 | | 20 |
| | | *THIRD YEAR* | |
| ChE 142, Chemical Engineering Thermodynamics I | 3 | ChE 143, Chemical Engineering Thermodynamics II | 3 |
| ChE 147, Application of Fluid Dynamics in Chem. Eng. | 3 | ChE 145, Chemical Reaction Engineering | 3 |
| ChE 149, Transport Phenomena | 3 | ChE 153, Transfer Operations I | 3 |
| ChE 152, Separation Processes | 3 | ChE 154, Transfer Operations II | 3 |
| ENSC 13, Strength of Materials | 3 | ChE 172, Introduction to Biochemical Engineering | 3 |
| STAT 168, Response Surface Methodology | 3 | ChE 180, Agro-Industrial Waste Management | 3 |
| COMM 10, Critical Perspectives in Communication | 3 | ENG 10, Writing of Scientific Paper | 3 |
| | 21 | | 21 |
| | | *MIDYEAR* | |
| | | ChE 198, Internship | 3 |
| | | *FOURTH YEAR* | |
| ChE 157.1, Chem. Eng. Unit Operations Laboratory | 2 | ChE 170, Instrumentation and Process Dynamics and Control | 3 |
| ChE 191, Special Topics | 3 | ChE 185, Chemical Engineering Laws, Ethics, Specifications and Contracts | 2 |
| ChE 192, Chemical Process Equipment Design | 3 | ChE 193, Plant Design | 3 |
| ChE 200/b/c, UndergraduateThesis or Innovationeering or Engineering Industry Research | 3 | ChE 199, Plant Inspection and Seminar | 1 |
| Cognate | 3 | ChE 200/b/c, UndergraduateThesis or Innovationeering or Engineering Industry Research | 3 |
| ETHICS 1, Ethics and Moral Reasoning in Everyday Life | 3 | Cognate | 3 |
| GE, (Elective) | 3 | | 15 |
| | 20 | | |

**TOTAL NUMBER OF UNITS 163**

**BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING**

(Major in Pulp and Paper Technology)

Special UPLB UC Meeting 21-22 May 2018; President's Approval 28 August 2019

| *First Semester* | *Units* | *Second Semester* | *Units* |
|---|---|---|---|
| | | *FIRST YEAR* | |
| CHEM 18, University Chemistry | 3 | CHEM 32, Quantitative Inorganic Analysis | 3 |
| CHEM 18.1, University Chemistry Laboratory | 2 | CHEM 32.1, Quantitative Inorganic Analysis Laboratory | 2 |
| MATH 27, Analytical Geometry & Calculus II | 3 | CHEM 40, Basic Organic Chemistry | 4 |
| PHYS 51, Elements of Physics | 4 | CHEM 40.1, Basic Organic Chemistry Laboratory | 1 |
| PHYS 51.1, Elements of Physics Laboratory | 1 | MATH 28, Analytical Geometry and Calculus II | 3 |
| MCB 11, Biology and Applications of Microorganisms | 3 | GE, (Elective) | 3 |
| ChE 10, Introduction to Chem. Eng. Profession | 1 | ARTS 1, Critical Perspectives in the Arts | 3 |
| PI 10, The Life and Works of Jose Rizal | 3 | STS 1, Science, Technology and Society | 3 |
| HK 11, Wellness and Basic Injury Management | (2) | HK 12, Human Kinetics Activities | (2) |
| NSTP 1, National Service Training Program I | (3) | NSTP 2, National Service Training Program II | (3) |
| | 20 | | 22 |
| | | *SECOND YEAR* | |
| ChE 30, Fundamentals of Chemical Engineering | 4 | ChE 32, Industrial Stoichiometry | 3 |
| ENSC 11, Statics of Rigid Bodies | 3 | FPPS 111, Wood and Fiber Anatomy | 3 |
| ENSC 10.1, Engineering Graphics Laboratory | 2 | FPPS 131, Wood Chemistry I | 3 |
| EE 1, Basic Electrical Engineering | 3 | ENSC 12, Dynamics of Rigid Bodies | 3 |
| CHEM 160, Introductory Biochemistry | 3 | ENSC 21, Mathematical Methods in Engineering | 3 |
| CHEM 111, Physical Chemistry I | 3 | CHEM 111.1, Physical Chemistry I Laboratory | 2 |
| KAS1/HIST 1, Kasaysayan ng Pilipinas/Philippine History | 3 | CHEM 112, Physical Chemistry II | 3 |
| HK12/HK13, Human Kinetics Activities/ Advanced Human Kinetics Activities | (2) | HK12/HK13, Human Kinetics Activities/ Advanced Human Kinetics Activities | (2) |
| | 21 | | 20 |
| | | *THIRD YEAR* | |
| ChE 142, Chemical Engineering Thermodynamics I | 3 | ENSC 26, Computer Applications in Engineering | 3 |
| ChE 147, Application of Fluid Dynamics in Chem. Eng | 3 | ChE 143, Chemical Engineering Thermodynamics II | 3 |
| ChE 149, Transport Phenomena | 3 | ChE 145, Chemical Reaction Engineering | 3 |
| ChE 152, Separation Processes | 3 | ChE 153, Transfer Operations I | 3 |
| FPPS 132, Pulp and Paper Technology | 3 | ChE 154, Transfer Operations II | 3 |
| FPPS 132.1, Pulp and Paper Laboratory | 2 | PPT 170, Instrumentation and Process Control for the Pulp and Paper Industry | 3 |
| ENSC 13, Strength of Materials | 3 | | |
| | 20 | COMM 10, Critical Perspectives in Communication | 3 |
| | | | 21 |
| | | *MIDYEAR* | |
| PPT 198, Internship | | 3 | |
| | | *FOURTH YEAR* | |
| ChE 157.1, Chem. Eng. Unit Operations Laboratory | 2 | PPT 193, Pulp and Paper Plant Design | 3 |
| ChE 185, Chemical Engineering Laws, Ethics, Specifications & Contracts | 2 | PPT 199, Undergraduate Seminar | 1 |
| | | PPT 200 or PPT 200b or PPT 200c, Undergraduate Thesis or Innovationeering or Engineering Industry Research | 3 |
| ChE 192, Chemical Process Equipment Design | 3 | | |
| PPT 188, Environmental Technology for the Pulp and Paper Industry | 3 | | |
| PPT 200/b/c, Undergraduate Thesis or Innovationeering or Engineering Industry Research | 3 | FPPS 183, Engineering Economic Analysis | 3 |
| | | ETHICS 1, Ethics and Moral Reasoning in Everyday Life | 3 |
| ENG 10, Writing of Scientific Paper | 3 | GE, (Elective) | 3 |
| STAT 168, Response Surface Methodology | 3 | GE, (Elective) | 3 |
| | 19 | | 19 |

**TOTAL NUMBER OF UNITS 165**

**BACHELOR OF SCIENCE IN CHEMICAL ENGINEERING**

(Major in Sugar Technology)

Special UPLB UC Meeting 21-22 May 2018; President's Approval 28 August 2019

| ***First Semester*** | ***Units*** | ***Second Semester*** | ***Units*** |
|---|---|---|---|
| | | *FIRST YEAR* | |
| ChE 10, Introduction to Chem. Eng. Profession | 1 | CHEM 32, Quantitative Inorganic Analysis | 3 |
| CHEM 18, University Chemistry | 3 | CHEM 32.1, Quantitative Inorganic Analysis Laboratory | 2 |
| CHEM 18.1, University Chemistry Laboratory | 2 | CHEM 40, Basic Organic Chemistry | 4 |
| MATH 27, Analytical Geometry & Calculus II | 3 | CHEM 40.1, Basic Organic Chemistry Laboratory | 1 |
| PHYS 51, Elements of Physics | 4 | MATH 28, Analytical Geometry & Calculus III | 3 |
| PHYS 51.1, Elements of Physics Laboratory | 1 | GE, (Elective) | 3 |
| MCB 11, Biology and Applications of Microorganisms | 3 | ARTS 1, Critical Perspectives in the Arts | 3 |
| PI 10, The Life and Works of Jose Rizal | 3 | STS 1, Science, Technology and Society | 3 |
| HK 11, Wellness and Basic Injury Management | (2) | HK 12, Human Kinetics Activities | (2) |
| NSTP 1, National Service Training Program I | (3) | NSTP 2, National Service Training Program II | (3) |
| | 20 | | 22 |
| | | *MIDYEAR* | |
| ENSC 11, Statics of Rigid Bodies | | 3 | |
| SUTC 148, Sugar Analysis & Factory Operations Control | | 3 | |
| | | 6 | |
| | | *SECOND YEAR* | |
| ChE 30, Fundamentals of Chemical Engineering | 4 | ENSC 26, Computer Applications in Engineering | 3 |
| SUTC 185, Sugar Laws and Economics | 2 | ChE 185, Chemical Engineering Laws, Ethics, Specifications and Contracts | 2 |
| ENSC 12, Dynamics of Rigid Bodies | 3 | | |
| EE 1, Basic Electrical Engineering | 3 | ENSC 10.1, Engineering Graphics Laboratory | 2 |
| CHEM 111, Physical Chemistry I | 3 | ENSC 21, Mathematical Methods in Engineering | 3 |
| CHEM 160, Introductory Biochemistry | 3 | CHEM 111.1, Physical Chemistry I Laboratory | 2 |
| KAS1/HIST1, Kasaysayan ng Pilipinas/Philippine History | 3 | CHEM 112, Physical Chemistry II | 3 |
| HK12/HK13, Human Kinetics Activities/ Advanced Human Kinetics Activities | (2) | GE, (Elective) | 3 |
| | | GE, (Elective) | 3 |
| | 21 | HK12/HK13, Human Kinetics Activities/ Advanced Human Kinetics Activities | (2) |
| | | *MIDYEAR* | 21 |
| ChE 32, Industrial Stoichiometry | | 3 | |
| SUTC 181, Waste Management in the Sugar Industry | | 3 | |
| | | 6 | |
| | | *THIRD YEAR* | |
| ChE 142, Chemical Engineering Thermodynamics I | 3 | ChE 143, Chemical Engineering Thermodynamics II | 3 |
| ChE 147, Application of Fluid Dynamics in Chem. Eng. | 3 | ChE 145, Chemical Reaction Engineering | 3 |
| ChE 149, Transport Phenomena | 3 | ChE 153, Transfer Operations I | 3 |
| ChE 152, Separation Processes | 3 | ChE 154, Transfer Operations II | 3 |
| COMM 10, Critical Perspectives in Communication | 3 | SUTC 154, Field & Factory Operations and Processes | 5 |
| ETHICS 1, Ethics and Moral Reasoning in Everyday Life | 3 | ENG 10, Writing of Scientific Papers | 3 |
| ENSC 13, Strength of Materials | 3 | | 20 |
| | 21 | | |
| | | *FOURTH YEAR* | |
| ChE 157.1, Chem. Eng. Unit Operations Laboratory | 2 | ChE 198, Internship | 3 |
| ChE 192, Chemical Process Equipment Design | 3 | SUTC 200 or SUTC 200b or SUTC 200c, Undergraduate Thesis or Innovationeering or Engineering Industry Research | 3/6 |
| SUTC 170, Instrumentation and Process Control Application to Sugar Industries | 3 | | |
| SUTC 171, Sugarcane By-Products Utilization and Sucrochemistry | 3 | | 6-9 |
| SUTC 193, Sugar Process Engineering and Plant Design | 3 | | |
| STAT 168, Response Surface Methodology | 3 | | |
| SUTC 200 or SUTC200b UndergraduateThesis or Innovationeering | (3) | | |
| | 17-20 | | |

**TOTAL NUMBER OF UNITS 163**

**BACHELOR OF SCIENCE IN CIVIL ENGINEERING**

Special UPLB UC Meeting 21-22 May 2018; President's Approval 28 August 2019

| *First Semester* | *Units* | *Second Semester* | *Units* |
|---|---|---|---|
| | | *FIRST YEAR* | |
| ARTS 1, Critical Perspectives in the Arts | 3 | ABE 48, Fundamentals of Surveying | 3 |
| CE 10, Fundamentals of Civil Engineering | 1 | ENSC 11, Statics of Rigid Bodies | 3 |
| ENSC 10.1, Engineering Graphics Laboratory | 2 | MATH 28, Analytic Geometry and Calculus III | 3 |
| KAS 1/HIST 1, Kasaysayan ng Pilipinas/Philippine History | 3 | PHYS 72, University Physics II | 4 |
| MATH 27, Analytic Geometry and Calculus II | 3 | PHYS 72.1, University Physics II Laboratory | 1 |
| PHYS 71, University Physics I | 4 | STS 1, Science, Technology and Society | 3 |
| PHYS 71.1, University Physics I Laboratory | 1 | GE Elective* | 3 |
| HK 11, Wellness and Basic Injury Management | (2) | HK 12, Human Kinetics Activities | (2) |
| | 17 | | 20 |
| | | *SECOND YEAR* | |
| EE 1, Basic Electrical Engineering | 3 | CHEM 18, University Chemistry | 3 |
| ENSC 12, Dynamics of Rigid Bodies | 3 | CHEM 18.1, University Chemistry Laboratory | 2 |
| ENSC 13, Strength of Materials | 3 | CE 120, Higher Surveying | 3 |
| ENSC 21, Mathematical Methods in Engineering | 3 | CE 131, Structural Analysis I | 3 |
| STAT 101, Statistical Methods | 3 | ENSC 16, Fluid Mechanics | 3 |
| GE Elective* | 3 | ETHICS 1, Ethics and Moral Reasoning in Everyday Life | 3 |
| GE Elective* | 3 | PI 10, The Life, Works, and Writings of Rizal | 3 |
| HK12/HK13, Human Kinetics Activities/ Advanced Human Kinetics Activities | (2) | HK12/HK13, Human Kinetics Activities/ Advanced Human Kinetics Activities | (2) |
| NSTP 1, National Service Training Program I | (3) | NSTP 2, National Service Training Program II | (3) |
| | 20 | | 21 |
| | | *THIRD YEAR* | |
| ABE 57, Field Hydrology | 3 | CE 122, Transportation Engineering II | 3 |
| CE 121, Transportation Engineering I | 3 | CE 134, Design of Reinforced Concrete Members | 4 |
| CE 132, Structural Analysis II | 3 | CE 152, Sanitary Engineering II | 3 |
| CE 133, Design of Timber Members | 3 | CE 161, Construction Materials and Testing | 3 |
| CE 151, Sanitary Engineering I | 3 | CE 163, Civil Engineering Laws, Contracts and Ethics | 2 |
| CE 170, Geotechnical Engineering | 3 | ENSC 16.1, Fluid Mechanics Laboratory | 2 |
| FPPS 183, Engineering Economic Analysis | 3 | IE 184, Project Development and Management | 3 |
| | 21 | | 20 |
| | | *MIDYEAR* | |
| CE 198, Internship | 3 | | |
| | | *FOURTH YEAR* | |
| CE 135, Design of Steel Members | 3 | ABE 67, Irrigation & Drainage Engineering I | 3 |
| CE 137, Structural Dynamics and Earthquake Engineering | 3 | CE 197, Civil Engineering Project Integration | 3 |
| CE 141, Hydraulic Engineering | 3 | CE 199, Undergraduate Seminar | 1 |
| CE 164, Construction Project Planning and Management | 4 | CE 200 or CE 200b, Undergraduate Thesis or Innovationeering | 3 |
| CE 171, Foundation Engineering | 3 | | |
| CE 200/b, Undergraduate Thesis or Innovationeering | 3 | COMM 10, Critical Perspectives in Communication | 3 |
| | 19 | ENG 10, Writing of Scientific Papers | 3 |
| | | ENSC 26, Computer Applications in Engineering | 3 |
| | | | 19 |

**TOTAL NUMBER OF UNITS 160**

**BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING**

Special UPLB UC Meeting 21 May 2018; President's Approval 28 August 2019

| *First Semester* | *Units* | *Second Semester* | *Units* |
|---|---|---|---|
| | | *FIRST YEAR* | |
| MATH 27, Analytic Geometry and Calculus II | 3 | MATH 28, Analytic Geometry and Calculus III | 3 |
| PHYS 71, University Physics I | 4 | PHYS 72, University Physics II | 4 |
| PHYS 71.1, University Physics I Laboratory | 1 | PHYS 72.1, University Physics II Laboratory | 1 |
| EE 30, Introduction to Electrical Engineering | 1 | ENSC 10.1, Engineering Graphics Laboratory | 2 |
| PI 10, Life and Works of Jose Rizal | 3 | ENSC 11, Statics of Rigid Bodies | 3 |
| ARTS 1, Critical Perspectives in the Arts | 3 | GE Elective | 3 |
| ETHICS 1, Ethics and Moral Reasoning in Everyday Life | 3 | GE Elective | 3 |
| HK 11, Wellness and Basic Injury Management | (2) | HK 12, Human Kinetics Activities | (2) |
| NSTP 1, National Service Training Program I | (3) | NSTP 2, National Service Training Program II | (3) |
| | 18 | | 19 |
| | | *SECOND YEAR* | |
| EE 40, Fundamentals of Electrical Engineering I | 4 | EE 50, Fundamentals of Electrical Engineering II | 4 |
| EE 45, Fundamentals of Engineering Electromagnetics | 3 | EE 51, Electromechanical Energy Conversion for DC | 3 |
| ENSC 12, Dynamics of Rigid Bodies | 3 | EE 55, Semiconductor Devices | 3 |
| ENSC 14a, Engineering Thermodynamics and Heat Transfer | 5 | ENSC 26, Computer Applications in Engineering | 3 |
| ENSC 21, Mathematical Methods in Engineering | 3 | HIST1/KAS1, Philippine History / Kasaysayan ng Pilipinas | 3 |
| STS 1, Science, Technology, and Society | 3 | GE Elective | 3 |
| HK 12/13, Human / Advanced Human Kinetics Activities | (2) | HK 12/13, Human / Advanced Human Kinetics Activities | (2) |
| | 21 | | 19 |
| | | *MIDYEAR* | |
| EE 198, Internship | 3 | | |
| | | *THIRD YEAR* | |
| EE 60, Signals and Systems | 3 | EE 70, Instrumentation Engineering | 4 |
| EE 65, Electronic Circuits | 4 | EE 75, Digital Electronics | 4 |
| EE 61, Electromechanical Energy Conversion for AC | 4 | EE 71, Analysis of Power Systems | 3 |
| EE 62, Principles of Power Systems | 3 | EE 79, Electrical Engineering Law, Ethics, and Contracts | 1 |
| EE 66 , Signals and Noise in Electrical Engineering Networks | 3 | FPPS 183, Engineering Economic Analysis | 3 |
| ENG 10, Writing of Scientific Papers | 3 | IE 184, Project Development and Management | 3 |
| | 20 | EE 199, Undergraduate Seminar | 1 |
| | | | 19 |
| | | *FOURTH YEAR* | |
| EE 85, Industrial Electronics | 3 | EE 200/b/c, Thesis or Innovationeering or Engineering Industry Research | 3 |
| EE 80, Control Systems Analysis | 3 | | |
| EE 86, Electronic Communication Systems I | 3 | SPEC, Specialization Course | 3 |
| EE 81, Maintenance of Electrical Equipment and Devices | 3 | SPEC, Specialization Course | 3 |
| COMM 10, Critical Perspectives in Communication | 3 | Elective, Elective | 3 |
| EE 200 or EE 200b or EE 200c, Thesis or Innovationeering or Engineering Industry Research | 3 | Elective, Elective | 3 |
| | | EE 91, Electrical System Design, Planning, and Estimation | 4 |
| SPEC, Specialization Course | 3 | | 19 |
| | 21 | | |

**TOTAL NUMBER OF UNITS 159**

**BACHELOR OF SCIENCE IN INDUSTRIAL ENGINEERING**

Special UPLB UC Meeting 05 / 21-22 / 18; President's Approval 08/28/19

| *First Semester* | *Units* | *Second Semester* | *Units* |
|---|---|---|---|
| | | *FIRST YEAR* | |
| ARTS 1, Critical Perspectives in the Arts | 3 | ENSC 11, Statics of Rigid Bodies | 3 |
| STS 1, Science, Technology and Society | 3 | MATH 28, Analytic Geometry and Calculus III | 3 |
| MATH 27, Analytic Geometry and Calculus II | 3 | IE 21, Industrial Processes | 3 |
| IE 10, Foundations of Industrial Engineering | 1 | IE 31, Industrial Organization and Management | 3 |
| PHYS 51, Elements of Physics | 4 | STAT 101, Statistical Methods | 3 |
| PHYS 51.1, Elements of Physics Laboratory | 1 | HIST 1/KAS 1, Philippine History/Kasaysayan ng Pilipinas | 3 |
| CHEM 18, University Chemistry | 3 | GE Elective, General Education | 3 |
| CHEM 18.1, University Chemistry Laboratory | 2 | HK 12 or 13, Human Kinetics Activities or Advanced Human Kinetics Activities | (2) |
| HK 11, Wellness and Basic Injury Management | (2) | | |
| NSTP 1, National Service Training Program I | (3) | NSTP 2, National Service Training Program II | (3) |
| | 20 | | 21 |
| | | *SECOND YEAR* | |
| PI 10, The Life and Works of Jose Rizal | 3 | ETHICS 1, Ethics and Moral Reasoning in Everyday Life | 3 |
| ENSC 21, Mathematical Methods in Engineering | 3 | ENSC 10.1, Engineering Graphics Laboratory | 2 |
| IE 125, Industrial Quality Control | 5 | ENSC 12, Dynamics of Rigid Bodies | 3 |
| IE 132, Methods Engineering | 5 | IE 142, Operations Research II | 3 |
| IE 141, Operations Research I | 3 | IE 150, Systems Evaluation | 3 |
| HK 12 or 13, Human Kinetics Activities or Advanced Human Kinetics Activities | (2) | IE 151, Production Systems | 3 |
| | | MGT 111, Principles of Accounting | 3 |
| | 19 | HK 12 or 13, Human Kinetics Activities or Advanced Human Kinetics Activities | (2) |
| | | | 20 |
| | | *MIDYEAR* | |
| IE 198 Internship | | 3 | |
| | | *THIRD YEAR* | |
| ENSC 13. Strength of Materials | 3 | ENSC 14a. Engineering Thermodynamics and Heat Transfer | 5 |
| ENSC 26. Computer Applications in Engineering | 3 | | |
| IE 134. Ergonomics | 3 | ENSC 16. Fluid Mechanics | 3 |
| IE 143. Stochastic Processes in Industrial Engineering | 3 | IE 136. Industrial Safety and Health | 3 |
| IE 152. Production Planning and Design | 3 | IE 144. Systems Simulation | 3 |
| ABE 43. Engineering Shop | 3 | IE 164. Information Systems I | 3 |
| | 18 | IE 184. Project Development and Management | 3 |
| | | | 20 |
| | | *FOURTH YEAR* | |
| Technical Cognate | 3 | Technical Cognate | 3 |
| ENG 10. Writing of Scientific Papers | 3 | IE 90. Ethics for Industrial Engineers | 2 |
| IE 158. Supply Chain Engineering | 3 | COMM 10. Critical Perspectives in Communication | 3 |
| IE 165. Information Systems II | 3 | GE Elective. General Education | 3 |
| IE 185. Industrial Systems Design | 3 | GE Elective. General Education | 3 |
| IE 199. Undergraduate Seminar | 1 | EE 1. Basic Electrical Engineering | 3 |
| IE 200/200b/200c. Thesis/Innovationeering/EIR | 3 | IE 200/200b/200c. Thesis/Innovationeering/EIR | 3 |
| | 19 | | 20 |

**TOTAL NUMBER OF UNITS 160**

**BACHELOR OF SCIENCE IN MECHANICAL ENGINEERING**

UPLB UC Meeting 17 July 2020; BOR Approval 29 October 2020

| *First Semester* | *Units* | *Second Semester* | *Units* |
|---|---|---|---|
| | | *FIRST YEAR* | |
| KAS1/HIST1, Kasaysayan ng Pilipinas/Philippine History | 3 | ARTS 1, Critical Perspectives in the Arts | 3 |
| ME 10, Introduction to Mechanical Engineering | 1 | EE 1, Basic Electrical Engineering | 3 |
| ENSC 10.1, Engineering Graphics Laboratory | 2 | PI 10, The Life and Works of Jose Rizal | 3 |
| CHEM 18, University Chemistry | 3 | ENSC 11, Statistics of Rigid Bodies | 3 |
| CHEM 18.1, University Chemistry Lab | 2 | MATH 28, Analytical Geometry and Calculus III | 3 |
| MATH 27, Analytical Geometry and Calculus II | 3 | IE 31, Industrial Organization and Management | 3 |
| PHYS 71, University Physics I | 4 | ABE 43, Engineering Shop | 3 |
| PHYS 71.1, University Physics I Lab | 1 | NSTP I, National Service Training Program 1 | (3) |
| HK 11, Wellness and Basic Injury Management | (2) | HK 12, Human Kinetics Activities | (2) |
| | 19 | | 21 |
| | | *SECOND YEAR* | |
| ETHICS 1, Ethics and Moral Reasoning in Everyday Life | 3 | EE 3, Basic Electrical Machines | 4 |
| EE 2, Basic Electronics Engineering | 4 | ENSC 15, Fundamentals of Heat Transfer | 3 |
| ENSC 12, Dynamics of Rigid Bodies | 3 | ENSC 16, Fluid Mechanics | 3 |
| ENSC 13, Strength of Materials | 3 | ENSC 21, Mathematical Methods in Engineering | 3 |
| ENSC 14, Basic Thermodynamics | 3 | ME 45, Analysis of Machine Elements | 3 |
| AMPE 113, Manufacturing Processes | 3 | ME 70, Mechanical Engineering Thermodynamics | 3 |
| NSTP 2, National Service Training Program 2 | (3) | HK 12/13, Human Kinetic Activities / Advanced Human Kinetics | (2) |
| HK 12/13, Human Kinetic Activities / Advanced Human Kinetics | (2) | | |
| | 19 | | 19 |
| | | *THIRD YEAR* | |
| STS 1, Science, Technology and Society | 3 | COMM 10, Critical Perspectives in Communication Arts | 3 |
| IE 150, Systems Evaluation | 3 | ENG 10, Writing of Scientific Papers | 3 |
| ABE 53, Machine Design for Bioproduction Systems I | 4 | ENSC 26, Computer Applications in Engineering | 3 |
| ME 160, Mechanical Vibrations | 3 | ME 154, Design of Machinery | 3 |
| ME 171, Fluid Machinery | 3 | ME 173.1, Mechanical Engineering Laboratory I | 1 |
| ME 172, Combustion Engineering | 2 | ME 176, Air-conditioning and Ventilation Systems | 3 |
| ME 175, Refrigeration Systems | 3 | IE 184, Project Development and Management | 3 |
| | 21 | | 19 |
| | | *MIDYEAR* | |
| ME 198, Internship | | 3 | |
| | | *FOURTH YEAR* | |
| GE Elective, General Education | 3 | GE Elective, General Education | 3 |
| EE 28, Introduction to Control Systems | 3 | GE Elective, General Education | 3 |
| STAT 101, Statistical Method | 3 | ME 181, Industrial Plant Engineering and Design | 4 |
| ME 90, Mechanical Engineering Laws, Ethics, Codes, and Standards | 2 | ME 182, Power Plant Engineering and Design | 4 |
| ME 174.1, Mechanical Engineering Laboratory II | 2 | ME 200/200b/200c, Thesis/Innovationeering/EIR | 3 |
| ME 199, Undergraduate Seminar | 1 | Elective: ME 158/AMPE 123/AMPE 133/AMPE 134/ EE 188. Introduction to Biomechanical Engineering/Design of Renewable Energy Systems (Solar, Biomass, Wind and Micro-hydro)/Introduction to Mechatronics | 3 |
| ME 200/200b/200c, Thesis/Innovationeering/EIR | 3 | | |
| Elective: ME 158/AMPE 123/AMPE 133/AMPE 134/EE 188. Introduction to Biomechanical Engineering/ Design of Renewable Energy Systems (Solar,Biomass, Wind and Micro-hydro)/ Introduction to Mechatronics | 3 | | 20 |
| | 20 | | |

**TOTAL NUMBER OF UNITS 161**

**BACHELOR OF SCIENCE IN MATERIALS ENGINEERING**

UPLB UC Meeting 25 July 2022; President's Approval 28 July 2022

| *First Semester* | *Units* | *Second Semester* | *Units* |
|---|---|---|---|
| | | *FIRST YEAR* | |
| KAS1/HIST1, Kasaysayan ng Pilipinas/Philippine History | 3 | ARTS 1, Critical Perspectives in the Arts | 3 |
| COMM 10, Critical Perspectives in Communication | 3 | MATH 28, Analytic Geometry and Calculus III | 3 |
| MATH 27, Analytic Geometry and Calculus II | 3 | CHEM 40, Basic Organic Chemistry | 4 |
| PHYS 71, University Physics I | 4 | CHEM 40.1, Basic Organic Chemistry Laboratory | 1 |
| PHYS 71.1, University Physics I Laboratory | 1 | ENSC 10.1, Engineering Graphics Laboratory | 2 |
| CHEM 18, University Chemistry | 3 | ENSC 11, Statics of Rigid Bodies | 3 |
| CHEM 18.1, University Chemistry Laboratory | 2 | EE 1, Basic Electrical Engineering | 3 |
| MatE 10, Introduction to Materials Engineering | 1 | MatE 21, Structure-Property Relationship of Materials I | 3 |
| HK 11, Wellness and Basic Injury Management | (2) | HK 12, Human Kinetics Activities | (2) |
| | 20 | | 22 |
| | | *SECOND YEAR* | |
| PHYS 72, University Physics II | 4 | ETHICS 1, Ethics and Moral Reasoning in Everyday Life | 3 |
| PHYS 72.1, University Physics II Laboratory | 1 | MatE 22, Structure-Property Relationship of Materials II | 4 |
| CHEM 32, Quantitative Inorganic Analysis | 3 | MatE 23, Structure-Property Relationship of Materials III | 3 |
| CHEM 32.1, Quantitative Inorganic Analysis Laboratory | 2 | MatE 103, Rate Processes in Materials Engineering | 4 |
| ENSC 13, Strength of Materials | 3 | ENSC 12, Dynamics of Rigid Bodies | 3 |
| ENSC 21, Mathematical Methods in Engineering | 3 | EE 2, Basic Electronics Engineering | 4 |
| MatE 101, Thermodynamics of Materials | 4 | NSTP 2, National Service Training Program II | (3) |
| NSTP 1, National Service Training Program I | (3) | | 21 |
| | 20 | | |
| | | THIRD YEAR | |
| STS 1, Science, Technology and Society | 3 | GE Elective | 3 |
| ENSC 16, Fluid Mechanics | 3 | IE 184, Project Management and Development | 3 |
| ENSC 26, Computer Applications in Engineering | 3 | MatE 165, Materials Synthesis and Processing | 3 |
| IE 150, Systems Evaluation | 3 | MatE 165.1, Materials Synthesis and Processing Laboratory | 2 |
| STAT 162, Experimental Designs | 3 | MatE 175, Materials Fabrication | 3 |
| MatE 105, Materials Analysis and Testing | 4 | MatE 175.1, Materials Fabrication Laboratory | 2 |
| HK 12/13, Human Kinetics Activities/Advanced Human Kinetics Activities | (2) | MatE 199, Undergraduate Seminar | 1 |
| | | HK 12/13, Human Kinetics Activities/Advanced Human Kinetics Activities | (2) |
| | 19 | | 17 |
| | | *MIDYEAR* | |
| MatE 198, Internship | | 3 | |
| | | *FOURTH YEAR* | |
| GE Elective | 3 | GE Elective | 3 |
| ENG 10, Writing of Scientific Papers | 3 | PI 10, Life and Works of Jose Rizal | 3 |
| MatE 171, Degradation of Materials | 3 | MatE 90, Laws and Ethics for Materials Engineers | 2 |
| MatE 194, Materials Selection and Design | 5 | MatE173, Forensic Engineering in Materials | 3 |
| MatE Elective | 3 | MatE Elective | 3 |
| ME 200/200b/200c, Undergraduate Thesis/ Innovationeering/EIR | 3 | ME 200/200b/200c, Undergraduate Thesis/ Innovationeering/EIR | 3 |
| | 20 | | 17 |

**TOTAL NUMBER OF UNITS 159**

# COURSES

## INSTITUTE OF AGRICULTURAL AND BIOSYSTEMS ENGINEERING

### AGRICULTURAL, FOOD AND BIOPROCESS ENGINEERING DIVISION

**ABE 2. Fundamentals of Agricultural and Biosystems Engineering II (3).** Structures and machinery for crop/animal production and processing. 5 hrs (2 class, 3 lab). PR. COI. Course Stipulation. Sophomore standing. (1,2)

**ABE 56. Engineering Properties of Agricultural and Biological Materials (3).** Physical characteristics, electrical, mechanical, thermal, and optical properties of biological materials for food, feed, fiber, and industrial uses. 5 hrs (2 class, 3 lab). PR. ENSC 13. (1,2)

**ABE 65. Quantitative Approaches in Agricultural and Biosystems Engineering (3).** Mathematical tools for agricultural and biosystems engineering applications: solutions of ordinary differential equations, vector analysis, linear algebra, linear programming, multi-criteria decision making in agricultural and biosystems engineering. 3 hrs (class). PR. MATH 28. (1,2)

**ABE 66. Agricultural Processing I (3).** Principles and practices in the primary processing, handling and storage of agricultural crops including refrigeration and cold storage systems. 5 hrs (2 class, 3 lab). PR. ABE 56. (1,2)

**ABE 80. Computer-aided Solutions in Agricultural and Biosystems Engineering (3).** Design and implementation of algorithms for solving agricultural and biosystems engineering problems. 5 hrs (2 class, 3 lab). PR. MATH 28 and COI. Course Stipulation: Junior standing and must have taken one ABE subject with laboratory. (1,2)

**ABE 190. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (2)

**ABE 191. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (2)

**ABE 198. Internship (3).** PR. COI. (1,2,M)

**ABE 199. Undergraduate Seminar (1).** May be taken twice. PR. Senior standing. (1)

**ABE 200. Undergraduate Thesis (6).** PR. COI. (1,2,M)

**ABE 200b. Innovationeering (6).** PR. COI. (1,2,M)

**ABE 200c. Engineering Industry Research (6).** PR. COI. (1,2,M)

**Agricultural, Food and Bioprocess Engineering**

**AFBE 155 (formerly ABE 155). Intermediate Thermodynamics in Agriculture and Biosystems (3).** Reversible and irreversible processes and cycles; availability; real gases; thermodynamic relations; binary mixtures. 3 hrs (class). PR. ENSC 14a or ENSC 14. (2)

**AFBE 156 (formerly ABE 153). Rheology of Biological Materials (3).** Mechanical properties, flow characteristics and mechanical damage of plant and animal products. 5 hrs (2 class, 3 lab). PR. ENSC 18 or ABE 56. (1)

**AFBE 165 (formerly ABE 154). Fuels and Combustion for Applications in Agriculture and Biosystems (3).** Properties of solid, liquid, and gaseous fuels; theory of combustion; principles and practices of burners and furnaces; design of heating systems. 5 hrs (2 class, 3 lab). PR. ENSC 14a or ENSC 15 or ChE 142. (1)

**AFBE 166 (formerly ABE 151). Agricultural Processing II (3).** Unit operations in agricultural process engineering. 5 hrs (2 class, 3 lab). PR. ABE 66. (1,2)

**AFBE 176 (formerly ABE 152). Agricultural Processing Plant Design and Management (3).** Principles and practices in plant design; process and economic analysis; plant operation and management. 5 hrs (2 class, 3 lab). PR. ABE 66 and IE 150 or FPPS 183. (2)

**AFBE 186 (formerly ABE 156). Intermediate Refrigeration in Agriculture and Biosystems (3).** Air conditioning processes and systems, absorption refrigeration, thermoelectric cooling, direct contact cooling, thermal storage systems. 3 hrs (class). PR. ABE 66. (1)

**AFBE 196 (formerly ABE 157). Postharvest Engineering of Perishable Crops (3).** Role and importance of handling systems for perishables; internal and external factors affecting food quality, safety, and shelf life; engineering aspects of postharvest handling systems and packing house operations for perishable crops. 5 hrs (2 class, 3 lab). PR. HORT 180 and ABE 66. (2)

### AGRIBIOSYSTEMS MACHINERY AND POWER ENGINEERING DIVISION

**ABE 2. Fundamentals of Agricultural and Biosystems Engineering II (3).** Structures and machinery for crop/animal production and processing. 5 hrs (2 class, 3 lab). PR. COI. Course Stipulation: Sophomore standing. (1,2)

**ABE 30. Introduction to Agricultural and Biosystems Engineering (1).** Nature and scope of agricultural and biosystems engineering; professional opportunities in the Philippines. (1 hr class). PR. None. (1,2)

**ABE 43 (formerly ABE 31). Engineering Shop (3).** Engineering shop materials, equipment, processes and safety. 5 hrs (2 class, 3 lab). PR ENSC 10.1. (1,2)

**ABE 53 (formerly ABE 40). Machine Design for Bioproduction Systems I (4).** Fundamentals of machine design as applied to bio-production systems. 8 hrs (2 class, 6 lab). PR. ENSC 12 and ENSC 13. (1,2)

**ABE 63 (formerly ABE 41). Agricultural and Biosystems Power Engineering (4).** Conventional and non-conventional

sources of power and their measurements for agricultural and biosystems applications. 6 hrs (3 class, 3 lab). PR. ENSC 14a or ENSC 15. (1,2)

**ABE 74 (formerly ABE 42). Machinery for Bioproduction Systems, Management, and Technopreneurship. (4).** Development, management, and commercialization of bioproduction systems machinery. 6 hrs (3 class, 3 lab). PR. ABE 53 and FPPS 183. (1,2)

**ABE 79 (formerly ABE 49). Agricultural and Biosystems Engineering Laws, Specifications, Contracts, and Ethics (1).** Laws and ethical practice of the Agricultural and Biosystems Engineering profession. 1 hr (class). PR. COI. (1)

**ABE 83 (formerly ABE 47). Electrical System Design for Agricultural and Biosystems Structures (3).** Generation, transmission, distribution, and utilization of electric power; design of electrical systems and controls for biosystems. 5 hrs (2 class, 3 lab). PR. ABE 52 and PHYS 51 and PHYS 51.1. (2)

**ABE 182 (formerly ABE 145). Soil Mechanics in Agricultural and Biosystems Engineering (3).** Soil mechanics as applied to foundations of agricultural structures and embankments; and to tillage and traction equipment. 5 hrs (2 class, 3 lab). PR. SOIL 1 or AGRI 51 and ENSC 13. (2)

**ABE 190. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (2)

**ABE 191. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (2)

**ABE 198. Internship (3).** PR. COI. (1,2,M)

**ABE 199. Undergraduate Seminar (1).** May be taken twice. PR. Senior standing. (1)

**ABE 200. Undergraduate Thesis (6).** PR. COI. (1,2,M)

**ABE 200b. Innovationeering (6).** PR. COI. (1,2,M)

**ABE 200c. Engineering Industry Research (6).** PR. COI. (1,2,M)

**Agribiosystems Machinery and Power Engineering**

**AMPE 113 (formerly ABE 143). Manufacturing Processes (3).** Materials, equipment and processes in the manufacture of agricultural tools and machinery parts. 5 hrs (2 class, 3 lab). PR. ABE 43. (1)

**AMPE 123 (formerly ABE 137). Design of Solar Energy Systems (3).** Principles of solar energy collection; design of solar collectors and systems. 5 hrs (2 class, 3 lab). PR. ENSC 14a or ENSC 15. (1)

**AMPE 133 (formerly ABE 136). Design of Biomass Energy Systems (3).** Biomass energy resource calculations; design of biomass energy conversion systems. 5 hrs (2 class, 3 lab). PR. ENSC 14a or ENSC 15. (1)

**AMPE 134 (formerly ABE 138). Design of Wind and Micro-Hydro Systems (3).** Wind and micro-hydro energy resource calculations; design of energy conversion systems. 5 hrs (2 class, 3 lab). PR. ENSC 16. (2)

**AMPE 153 (formerly ABE 140). Machine Design for Bioproduction Systems II (3).** Design of machine elements and systems; limit dimensioning; materials and processes; dynamic loading; creative design. 7 hrs (1 class, 6 comp). PR. ABE 53. (2)

**AMPE 173 (formerly ABE 142). Agricultural Mechanization (3).** Principles and practices in agricultural mechanization; mechanization management. 5 hrs (2 class, 3 comp). PR. ABE 74. (1)

**AMPE 183 (formerly ABE 147). Mechatronics for Agriculture and Biosystems (3).** Fundamentals of instrumentation and control engineering applied in agriculture and biosystems; digital and analog electronics, sensors and actuators in feedback control systems, data acquisition systems, microcontroller and programmable logic controller, integration of mechanical and electronic designs, case studies. 8 hrs (2 class, 6 lab). PR. PHYS 51 and PHYS 51.1. (2)

**AGROMETEOROLOGY, BIO-STRUCTURES AND ENVIRONMENT ENGINEERING DIVISION**

**ABE 1. Fundamentals of Agricultural and Biosystems Engineering I (3).** Weather elements, crop and livestock environment, soil and water management in agricultural production systems; agricultural waste management. 5 hrs (2 class, 3 lab). PR. AGRI 51. (1,2,M)

**ABE 52 (formerly ABE 11). Agricultural Structures I (3).** Materials of engineering; properties and use of construction materials for agricultural structures; agricultural structure design. 5 hrs (2 class, 3 comp). PR. ENSC 10.1 and ENSC 13. (1,2)

**ABE 62 (formerly ABE 12). Environmental Control Engineering (3).** Analysis and design of environmental control in agricultural structures with emphasis on tropical conditions; principles of controlled environment agriculture. 5 hrs (2 class, 3 comp). PR. ABE 52. (1,2)

**ABE 190. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (2)

**ABE 191. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (2)

**ABE 198. Internship (3).** PR. COI. (1,2,M)

**ABE 199. Undergraduate Seminar (1).** May be taken twice. PR. Senior standing. (1)

**ABE 200. Undergraduate Thesis (6).** PR. COI. (1,2,M)

**ABE 200b. Innovationeering (6).** PR. COI. (1,2,M)

**ABE 200c. Engineering Industry Research (6).** PR. COI. (1,2,M)

**Agrometeorology, Bio-structures and Environment Engineering**

**ABSE 141 (formerly ABE 110). Plant Climate (3).** Heat exchange near the ground; relation to topography and plant cover to the micro-climate; modification of micro-climate by agricultural

operation. 3 hrs (class). PR. COI. Course Stipulation: BS ABE students must have approved specialization and plan of coursework. (1)

**ABSE 142 (formerly AGME 110). Geometeorology (3).** Atmospheric environment; chemical quality circulation and variability of meteorological factors; surface energy budget; earth materials and processes. 3 hrs (class). PR. COI. (2)

**ABSE 152 (formerly ABE 111). Agricultural Structure II (3).** Design methods and codes for timber, steel, and reinforced concrete structures; design and construction of farm structures; agricultural infrastructure development; works engineering and contracts. 5 hrs (2 class, 3 comp). PR. ABE 62. (1)

**ABSE 162 (formerly ABE 112). Agricultural Waste Management (3).** Principles of agricultural waste management; collection, storage, transport, treatment, and utilization of agricultural wastes. 5 hrs (2 class, 3 comp). PR. ABE 62. (2)

**ABSE 172 (formerly ABE 113). Farmstead Planning (3).** Basic concepts and fundamentals of farmstead planning; layout and organization of farmstead systems. 3 hrs (class). PR. ABE 62. (2)

**ABSE 181 (formerly ABE 114). Spatial Analysis in Hydrometeorology (3).** Spatial distribution of climatic elements and soil moisture; digital terrain analysis; spatial interpolation. 5 hrs (2 class, 3 lab). PR. ABE 57. (1)

**ABSE 182 (formerly ABE 115). Agricultural Structure III (3).** Design of agricultural structures; preparation of agricultural drawings; estimation of construction cost. 7 hrs (1 class, 6 lab). PR. ABSE 152. (2)

**LAND AND WATER RESOURCES ENGINEERING DIVISION**

**ABE 1. Fundamentals of Agricultural and Biosystems Engineering I (3).** Weather elements, crop and livestock environment, soil and water management in agricultural production systems; agricultural waste management. 5 hrs (2 class, 3 lab). PR. AGRI 51. (1,2,M)

**ABE 48 (formerly ABE 70). Fundamentals of Surveying (3).** Surveying principles and applications; measurement of distances, elevations, directions and errors; profile and topographic surveying; earthwork calculations; land grading; elementary aerial photogrammetry. 7 hrs (1 class, 6 lab). PR. ENSC 10a or ENSC 10.1. (1,2)

**ABE 57 (formerly ABE 71). Field Hydrology (3).** Hydrologic processes; streamflow hydrographs; mathematical models; hydrology and water quality. 5 hrs (2 class, 3 lab). PR. COI. Course Stipulation: COI is given to students who have taken or are currently registered in ENSC 16. (1,2)

**ABE 67 (formerly ABE 72.) Irrigation and Drainage Engineering I (3).** Basic soil-plant-water relationships; flow measurements; selection and efficiency of pumps; planning and design of irrigation and drainage systems. 5 hrs (2 class, 3 lab). PR. ABE 48 and ABE 57. (1,2)

**ABE 77 (formerly ABE 73). Soil and Water Conservation Engineering (3).** Design, construction, and maintenance of water conservation works, drainage, and erosion control facilities. 5 hrs (2 class, 3 comp). PR. ABE 48 and ABE 57. (1,2)

**ABE 88 (formerly ABE 81). Aquaculture Engineering I (3).** Principles of planning aquaculture systems; layout of farm facilities. 5 hrs (2 class, 3 lab). PR. ABE 57. (1,2)

**ABE 180. Soil Engineering (3).** Basic engineering properties of soils; analyses of compressive and shear stresses; lateral pressures, retaining structures, slope stability, bearing capacity and foundations; subsurface exploration methods. 3 hrs (class). PR. ENSC 13 and ENSC 16. (1)

**ABE 190. Special Problems (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (2)

**ABE 191. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (2)

**ABE 198. Internship (3).** PR. COI. (1,2,M)

**ABE 199. Undergraduate Seminar (1).** May be taken twice. PR. Senior standing. (1)

**ABE 200. Undergraduate Thesis (6).** PR. COI. (1,2,M)

**ABE 200b. Innovationeering (6).** PR. COI. (1,2,M)

**ABE 200c. Engineering Industry Research (6).** PR. COI. (1,2,M)

**Land and Water Resources Engineering**

**LWRE 167 (formerly ABE 172). Irrigation and Drainage Engineering II (3).** Planning, design, layout, construction, operation and maintenance of irrigation and drainage systems. 5 hrs (2 class, 3 lab). PR. ABE 67. (1)

**LWRE 177 (formerly ABE 174). Open Channel Hydraulics (3).** Flows in open channels; design of channels for uniform flow. 5 hrs (2 class, 3 lab). PR. ENSC 16. (1)

**LWRE 178 (formerly ABE 177). Principles of Tropical Water Quality Management (3).** Water quality problems and parameters; monitoring, control, and management systems. 5 hrs (2 class, 3 lab). PR. ABE 57. (2)

**LWRE 179 (formerly ABE 179). Water Resources Planning (3).** Water and land resources requirements for planning of water and land development, alternative basin plans; economic and financial analysis. 3 hrs (class). PR. ABE 77 and ECON 11 or FPPS 183. (1)

**LWRE 187 (formerly ABE 175). Water Control Structures (3).** Hydraulics of water control and measurement structures; criteria for selection and design of hydraulics structures; design of structures; construction methods. 5 hrs (2 class, 3 lab). PR. LWRE 177. (2)

**LWRE 188 (formerly ABE 181). Aquaculture Engineering II (3).** Design, construction, operation and maintenance of aquaculture

facilities. 5 hrs (2 class, 3 lab). PR. ABE 88 and ABE 67. (2)

## DEPARTMENT OF CHEMICAL ENGINEERING

### CHEMICAL ENGINEERING

**ChE 10. Introduction to Chemical Engineering Profession (1).** Scope and emerging trends in various areas of chemical engineering profession. 1 hr (class). PR. None. (1,2)

**ChE 30. Fundamentals of Chemical Engineering (4).** Principles of material and energy balances and their application to various chemical process industries. 6 hrs (3 class, 3 computation). PR. CHEM 18. (1,2)

**ChE 32. Industrial Stoichiometry (3).** Application of physico-chemical principles in the analysis and solution of industrial processes involving chemical reactions. 5 hrs (2 class, 3 lab). PR. ChE 30. (1,2,M)

**ChE 142. Chemical Engineering Thermodynamics I (3).** The first law of thermodynamics, ideal gas concepts, pressure-volume-temperature relationships of fluids, heat effects; second law of thermodynamics, other thermodynamic properties of fluids. 3 hrs (class). PR. CHEM 111 and ChE 30. (1,2)

**ChE 143. Chemical Engineering Thermodynamics II (3).** Thermodynamic flow processes, power cycles, refrigeration, phase equilibria, chemical reaction equilibria. 3 hrs (class). PR. ChE 142. (1,2)

**ChE 145. Chemical Reaction Engineering (3).** Fundamental principles of reaction engineering and their applications. 3 hrs (class). PR. CHEM 112, ENSC 21, and ChE 30. (1,2)

**ChE 147. Application of Fluid Dynamics in Chemical Engineering (3).** Concepts and principles of fluid dynamics and their applications. PR. ENSC 12 and ChE 30. (1,2)

**ChE 149. Transport Phenomena (3).** Physical rate processes with particular emphasis on the formulation and solution of typical boundary value problems associated with heat, mass, and momentum transport; equations of change, molecular and turbulent transport. 3 hrs (class). PR. ENSC 21 and ChE 30. (1,2)

**ChE 152. Separation Processes (3).** Unified treatment of separation processes with primary emphasis on the concept of equilibrium stage, formulation, numerical and graphical solution technique; application of principles to separation processes - distillation, liquid extraction, and leaching. 3 hrs (class). PR. ChE 30. (1,2)

**ChE 153. Transfer Operations I (3).** Applications of the principles of rate processes, unified treatment of mass, heat and simultaneous heat and mass transfer operations. 3 hrs (class). PR. ChE 149. (1,2)

**ChE 154. Transfer Operations II (3).** Applications of the principles of transfer and separation processes in cooling tower and packed column design, unified treatment of size reduction, screening and solids handling. 3 hrs (class). PR. ChE 149, ChE 152, and concurrent with ChE 153. (1,2)

**ChE 157.1. Chemical Engineering Unit Operations Laboratory (2).** Experimental study of unit operations and processes. 6 hrs (lab). PR. ChE 147, ChE 153, and ChE 154. (1,2)

**ChE 170. Instrumentation and Process Dynamics and Control (3).** Fundamentals of automatic control, instrumentation, analyses of process dynamics and control system. 3 hrs (class). PR. EE 1, ENSC 21, and ChE 30. (2)

**ChE 172. Introduction to Biochemical Engineering (3).** Chemical engineering principles as applied to enzyme and whole cell mediated bioprocesses. PR. MCB 11, ChE 149, ChE 152, and CHEM 160. (2)

**ChE 180. Agro-industrial Waste Management (3).** Changing practice in agro-industrial production; environmental impact analysis; waste characteristics; waste treatment and disposal fundamentals; waste recycling management. 3 hrs (class). PR. COI. (1,2)

**ChE 185. Chemical Engineering Laws, Ethics, Specifications, and Contracts (2).** Laws and code of ethics for chemical engineers; specifications and contracts; occupational health and safety. 2 hrs (class). PR. ChE 10. (1,2)

**ChE 191. Special Topics (1-3).** May be taken twice provided that the total number of units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**ChE 192. Chemical Process Equipment Design (3).** Mechanical design of chemical process equipment. 3 hrs (class). PR. ChE 145, ChE 153, ChE 154, and ENSC 13. (1,2)

**ChE 193. Plant Design (3).** Application of fundamental chemical engineering calculations and technopreneurship considerations on design of processing plant. 5 hrs (2 class, 3 computation). PR. ChE 32 and ChE 192. (1,2)

**ChE 198. Internship (3).** PR. COI. (1,2,M)

**ChE 199. Plant Inspection and Seminar (1).** PR. COI. (2)

**ChE 200. Undergraduate Thesis (6).** PR. COI. (1,2,M)

**ChE 200b. Innovationeering (6).** PR. COI. (1,2,M)

**ChE 200c. Engineering Industry Research (6).** PR. COI. (1,2,M)

### PULP AND PAPER TECHNOLOGY

**PPT 170. Instrumentation and Process Control for the Pulp and Paper Industry (3).** Principles and methods of control system analysis and design as applied to the pulp and paper industry. 3 hrs (class). PR. EE 1, ENSC 21, and FPPS 132. (2)

**PPT 188. Environmental Technology for the Pulp and Paper Industry (3).** Causes and control of pollution associated with the pulp and paper industry and methods for effluent treatment. 3 hrs (class). PR. FPPS 132 or COI. (1)

**PPT 193. Pulp and Paper Plant Design (3).** Computations of material balances, energy balances, power requirement, equipment balancing, cost and profitability estimation. 5 hrs (2 class, 3 lab). PR. ChE 32 and ChE 192. (2)

**PPT 198. Internship (3).** PR. COI. (1,2,M)

**PPT 199. Undergraduate Seminar (1).** PR. Senior standing. (2)

**PPT 200. Undergraduate Thesis (6).** PR. COI. (1,2,M)

**PPT 200b. Innovationeering (6).** PR. COI. (1,2,M)

**PPT 200c. Engineering Industry Research (6).** PR. COI. (1,2,M)

**SUGAR TECHNOLOGY**

**SUTC 148. Sugar Analysis and Factory Operations Control (3).** Technical analysis of sugar house products; chemical and industrial stoichiometry with specific application to operations control and sugar accounting and distribution. 5 hrs (2 class, 3 lab). PR. CHEM 18.1. (1,2,M)

**SUTC 154. Field and Factory Operations and Processes (5).** Operations and processes in sugarcane production, raw sugar manufacture and refining. 7 hrs (4 class, 3 lab). PR. ChE 149. (1,2)

**SUTC 170. Instrumentation and Process Control Application to Sugar Industries (3).** Principles and methods of instrumentation and control system analysis as applied to sugar industries. 3 hrs (class). PR. EE 1, ENSC 21, and SUTC 154. (1, 2)

**SUTC 171. Sugarcane-By-Products Utilization and Sucrochemistry (3).** Characterization, processing, and utilization of sugarcane-by-products; properties, synthesis, and reactions of sucrose. 5 hrs (2 class, 3 lab). PR. CHEM 40 or CHEM 44 and MCB 11. (1)

**SUTC 181. Waste Management in the Sugar Industry (3).** Types, sources, quantities of waste in sugar industry; effects of waste in receiving environment; waste handling practices; cleaner products/ pollution prevention, emission control. 3 hrs (class). PR. COI. (1,2,M)

**SUTC 185. Sugar Laws and Economics (2).** Laws affecting the sugar industry and the profession of sugar technology; production costs; consumption trends; international outlook. 2 hrs (class). PR. None. (1,2)

**SUTC 193. Sugar Process Engineering and Plant Design (3).** Material, steam and equipment balancing; design and specifications. 5 hrs (2 class, 3 lab). PR. SUTC 154. (1,2)

**SUTC 200. Undergraduate Thesis (6).** PR. COI. (1,2,M)

**SUTC 200b. Innovationeering (6).** PR. COI. (1,2,M)

**SUTC 200c. Engineering Industry Research (6).** PR. COI. (1,2,M)

## DEPARTMENT OF CIVIL ENGINEERING

**CIVIL ENGINEERING**

**CE 10. Fundamentals of Civil Engineering (1).** Nature, scope, and practice of Civil Engineering. 1 hr (class). PR. None. (1)

**CE 120 (formerly CE 12). Higher Surveying (3).** Topographic surveys; triangulation; solar and stellar observations; gravity, trigonometric, and barometric levelling; hydrographic surveys; route surveys for highway and railways. 7 hrs (1 class, 6 lab). PR. ABE 48. (2)

**CE 121. Transportation Engineering I (3).** Analysis of traffic flow and highway capacity; planning and geometric design of highways; and traffic control and survey. 5 hrs (2 class, 3 comp). PR. CE 120. (1)

**CE 122. Transportation Engineering II (3).** Fundamentals of highway, airport, and railway design and engineering. 3 hrs (class). PR. CE 121. (2)

**CE 131. Structural Analysis I (3).** Survey of structural systems; analysis of loads and influence lines; design of roof and bridge trusses. 5 hrs (2 class, 3 comp). PR. ENSC 13. (1,2)

**CE 132. Structural Analysis II (3).** Deflection of trusses; analyses of statically determinate and indeterminate beams and frames for different materials. 5 hrs (2 class, 3 comp). PR. CE 131. (1,2)

**CE 133. Design of Timber Members (3).** Design of timber structures; joints, splices, roof, and floor frames; bridge trusses. 5 hrs (2 class, 3 comp). PR. CE 131. (1)

**CE 134. Design of Reinforced Concrete Members (4).** Analysis and design of reinforced concrete beams, columns and slabs, and pre-stressed concrete beams. 6 hrs (3 class, 3 comp). PR. CE 132. (1,2)

**CE 135. Design of Steel Members (3).** Analysis and design of structural members using steel for buildings, bridges and other infrastructures. 5 hrs (2 class, 3 comp). PR. CE 132. (1,2)

**CE 137. Structural Dynamics and Earthquake Engineering (3).** Dynamic analysis of single and multiple degree of freedom systems, seismic response, and seismic design of structures. 3 hrs (class). PR. ENSC 21 and CE 132. (1,2)

**CE 141. Hydraulic Engineering (3).** Principles and applications of hydraulic engineering. 5 hrs (2 class, 3 comp). PR. ENSC 16.1. (1)

**CE 151. Sanitary Engineering I (3).** Sewerage and water supply system: principles, design and maintenance. 3 hrs (class). PR. CHEM 18, CHEM 18.1, and ENSC 16. (1)

**CE 152. Sanitary Engineering II (3).** Principles of waste-water treatment processes; design of treatment facilities. 3 hrs (class). PR. CE 151. (2)

**CE 161. Construction Materials and Testing (3).** Engineering properties and testing of construction materials. 5 hrs (2 class, 3 lab). PR. ENSC 13. (1,2)

**CE 163. CE Laws, Contracts, and Ethics (2).** Elements of contracts, bid proposals, and specifications for civil engineering projects; civil engineers' code of ethics. 2 hrs (class). PR. COI. (2)

**CE 164 (formerly CE 162). Construction Project Planning and Management (4).** Construction planning, job scheduling, selection

of construction equipment, and cost estimation. 4 hrs (class). PR. CE 134 and CE 163. (1)

**CE 170. Geotechnical Engineering (3).** Assessment of soil as an engineering material in civil engineering projects. 5 hrs (2 class, 3 lab). PR. ENSC 13 and ENSC 16. (1,2)

**CE 171. Foundation Engineering (3).** Mechanics of soils and rocks; phase relationships; consolidation behavior; site investigation and soil classification; foundation analysis and design; slope stability and soil improvement. 3 hrs (class). PR. CE 134 and CE 170. (1,2)

**CE 197. Civil Engineering Project Integration (3).** Analysis and design of a civil engineering project; preparation of technical drawings and cost estimate. 7 hrs (1 class, 6 lab). PR. CE 164 and CE 171. (1,2)

**CE 198. Internship (3).** PR. COI. (1,2,M)

**CE 199. Undergraduate Seminar (1).** May be taken twice. PR. Senior standing. (1,2)

**CE 200. Undergraduate Thesis (6).** PR. COI. (1,2,M)

**CE 200b. Innovationeering (6).** PR. COI. (1,2,M)

## DEPARTMENT OF ELECTRICAL ENGINEERING

### ELECTRICAL ENGINEERING

**EE 1. Basic Electrical Engineering (3).** Network laws and theorems; resistive and alternative current circuits; basic electronics; power transformers; introduction to logic cir- cuits and motors. 5 hrs (2 class, 3 lab). PR. MATH 27. (1,2)

**EE 2. Basic Electronics Engineering (4).** Introduction to PN junctions, transistors, Op-Amps, and sensors; their operation and engineering applications. 6 hrs (3 class, 3 lab). PR. EE 1. (1,2)

**EE 3. Basic Electrical Machines (4).** Introduction to DC and AC machines and transformers; their construction, operation, and circuit equivalent. 6 hrs (3 class, 3 lab). PR. EE 1. (1,2)

**EE 28. Introduction to Control Systems (3).** Basic control systems in linear feedback systems with instrumentation and automation. 5 hrs (2 class, 3 lab). PR. EE 2. (1,2)

**EE 30 (formerly EE 10). Introduction to Electrical Engineering (1).** Nature and scope of electrical engineering. 1 hr (class). PR. None. (1)

**EE 40 (formerly EE 11). Fundamentals of Electrical Engineering I (4).** Direct-current resistive circuit concepts, laws, circuit analysis and techniques. 6 hrs (3 class, 3 lab). PHYS 72 and PHYS 72.1. (1,2)

**EE 45 (formerly EE 18). Fundamentals of Engineering Electromagnetics (3).** Vector Analysis; steady electric and magnetic fields; dielectric and magnetic materials; time-varying fields; Maxwell's equations; applications to electrical engineering. 3 hrs (class). PR. PHYS 72 and MATH 28. (1,2)

**EE 50 (formerly EE 12). Fundamentals of Electrical Engineering II (4).** Transient response; sinusoidal steady state; resonance; transformer theory; and polyphase systems. 6 hrs (3 class, 3 lab). PR. EE 40. (1,2)

**EE 51 (formerly EE 41). Electromechanical Energy Conversion for DC (3).** Basic principles of electromechanical energy conversion; generalized machine model; performance characteristics of direct-current, synchronous and induction machines. 5 hrs (2 class, 3 lab). PR. EE 40 and EE 45. (1,2)

**EE 55. Semiconductor Devices (3).** Modeling of PN-junctions and characteristics of semiconductor devices. 5 hrs (2 class, 3 comp). PR. EE 40 and EE 45 (1,2)

**EE 60 (formerly EE 15). Signals and Systems (3).** Principles, operations, and analysis of continuous-and discrete-time signals and systems. 5 hrs (2 class, 3 lab). PR. EE 50 and ENSC 21. (1,2)

**EE 61 (formerly EE 141). Electromechanical Energy Conversion for AC (4).** Engineering aspects, performance characteristics, and applications of alternators, AC motors, and transformers. 6 hrs (3 class, 3 lab). PR. EE 51. (1,2)

**EE 62. Principles of Power Systems (3).** Power systems theories; economics of power system; protection and grounding. 3 hrs (class). PR. EE 45 and EE 50. (1,2)

**EE 65 (formerly EE 21). Electronic Circuits (4).** Applications of semiconductor devices, and operational amplifier circuits. 6 hrs (3 class, 3 lab). PR. EE 55. (1,2)

**EE 66 (formerly EE 170). Signals and Noise in Electrical Engineering Networks (3).** Analysis of signals and noise in communication systems and other electric networks. 3 hrs (class). PR. EE 40 and MATH 28. (1,2)

**EE 70 (formerly EE 130). Instrumentation Engineering (4).** Basic electrical instrumentation and measurement; sensing elements and circuits; programmable logic controllers. 6 hrs (3 class, 3 lab). PR. EE 1 or EE 65. (1,2)

**EE 71 (formerly EE 151). Analysis of Power Systems (3).** Modelling of electric power systems and implementation of load flow studies and fault calculations. 3 hrs (class). PR. EE 61 and EE 62. (1,2)

**EE 75 (formerly EE 120). Digital Electronics (4).** Digital numbering systems and codes; logic concepts and gates; Boolean algebra; combinational and sequential logic circuits; binary arithmetic operations; integrated circuit families; analog-to-digital and digital-to-analog conversion; digital measurements. 6 hrs (3 class, 3 lab). PR. EE 65. (1,2)

**EE 79 (formerly EE 90). Electrical Engineering Law, Ethics and Contracts (1).** Laws, ethics, and contracts governing the electrical engineering profession. 1 hr (class). PR. COI (Junior Standing). (2)

**EE 80 (formerly EE 131). Control Systems Analysis (3).** Continuous-time and feedback control system analysis, design, and

stability. 3 hrs (class). PR. EE 60. (1,2)

**EE 81. Maintenance of Electrical Equipment and Devices (3).** Testing procedures and standards for evaluation of test results for electrical preventive maintenance. 5 hrs (2 class, 3 lab). PR. EE 62. (1,2)

**EE 85 (formerly EE 126). Industrial Electronics (3).** Automation, phase control, and power circuits for industrial applications. 5 hrs (2 class, 3 lab). PR. EE 51 and EE 70. (1,2)

**EE 86 (formerly EE 171). Electronic Communication Systems I (3).** Basic concepts on the transmission and reception of signals in electronic communication systems. 3 hrs (class). PR. EE 60 and EE 75. (1,2)

**EE 91. Electrical System Design, Planning and Estimation (4).** Formation of electrical plans and development of estimates and schedules for electrical engineering projects. 6 hrs (3 class, 3 lab). PR. EE 61 and EE 79. (1,2)

**EE 161 (formerly EE 148). Electrical Machine Design (3).** Design practices for transformers, rotating machines, and selected electrical equipment and devices. 3 hrs (class). PR. EE 51. (1)

**EE 162. Reliability of Power Systems (3).** Modeling and evaluation of the reliability of generation systems, interconnected power systems, and distribution systems. 5 hrs (2 class, 3 lab). PR. EE 71. (1,2)

**EE 163 (formerly EE 159). Industrial Power Systems (3).** Principles and operations of industrial power systems, codes and recommended design practices. 5 hrs (2 class, 3 lab). PR. EE 71. (2)

**EE 175 (formerly EE 160). Digital Logic and Hardware Description (3).** Digital hardware description methods and applications. 5 hrs (2 class, 3 lab). PR. EE 75. (1,2)

**EE 176 (formerly EE 165). Microprocessor-Based Design (4).** Microprocessor organizations and programming; microcomputer development systems and interfacing techniques. 6 hrs (3 class, 3 lab). PR. EE 70 and EE 80. (2)

**EE 177. Power Electronics (3).** Switching converter principles, phase control circuits, rectifiers, DC-DC and DC-AC converters. 5 hrs (2 class, 3 lab). PR. EE 85. (2)

**EE 186 (formerly EE 179). Electronic Communication Systems II (3).** Radiowave propagation, components, and methods used in the analysis and design of electronic communication systems. 5 hrs (2 class, 3 lab). PR. EE 86. (2)

**EE 187. Digital Signal Processing (3).** Digital signal principles, operations, and analysis. 5 hrs (2 class, 3 lab). PR. EE 60 and EE 66. (2)

**EE 188. Introduction to Mechatronics and Robotics (3).** Mechatronics and robotic control in industrial automation. 5 hrs (2 class, 3 lab). PR. EE 28 or EE 80. (1,2)

**EE 190. Special Problems (1-3).** May be taken twice provided that the total number units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**EE 191. Special Topics (1-3).** May be taken twice provided that the total number units to be credited to the student's program will not exceed 4 units. PR. COI. (1,2)

**EE 198. Internship (3).** PR. COI. (1,2,M)

**EE 199. Undergraduate Seminar (1).** May be taken twice. 1 hr (class). PR. COI. COI will be given to students with Junior Standing. (1,2)

**EE 200. Undergraduate Thesis (6).** PR. COI. (1,2,M)

**EE 200b. Innovationeering (6).** PR. COI. (1,2,M)

**EE 200c. Engineering Industry Research (6).** PR. COI. (1,2,M)

## DEPARTMENT OF INDUSTRIAL ENGINEERING

### INDUSTRIAL ENGINEERING

**IE 10. Foundations of Industrial Engineering (1).** Industrial engineering history development, perspective, and competencies. 1 hr (class). PR. None. (1)

**IE 21. Industrial Processes (3).** Industrial processes and their effects on production system decisions; metal, plastic, ceramic, elastomer, fiber, wood and pulp processes, etc. 3 hrs (class). PR. PHYS 51 and CHEM 18. (1,2)

**IE 31. Industrial Organization and Management (3).** Basic features governing the industrial organization; administration and financing of industries; relations between management and labor. 3 hrs (class). PR. None. (1,2)

**IE 90. Ethics for Industrial Engineers (2).** Engineering code of ethics and relevant laws and regulations in industrial engineering practice. 2 hrs (class). PR. IE 31. (1,2)

**IE 125. Industrial Quality Control (5).** Statistical process control charts; specifications and tolerances; acceptance sampling; reliability and life testing. 7 hrs (4 class, 3 lab). PR. IE 21 and STAT 101. (1,2)

**IE 132. Methods Engineering (5).** Measurement, improvement, and design of work systems. 7 hrs (4 class, 3 lab). PR. IE 21 and IE 31. (1,2)

**IE 134. Ergonomics (3).** Anthropometry; biomechanics; human task analysis; displays and control; work environments; ergonomic work design and evaluation. 5 hrs (2 class, 3 lab). PR. IE 132. (1,2)

**IE 136. Industrial Safety and Health (3).** Accident prevention and reduction of health hazards in the work environment; control of noise, vibration and heat stress. 3 hrs (class). PR. IE 134. (1,2)

**IE 141. Operations Research I (3).** Operations research methodology; recurrent processes and problems in industrial

systems; optimization models for linear systems; linear programming, graph theory and network analysis. 3 hrs (class). PR. MATH 28. (1,2)

**IE 142. Operations Research II (3).** Other OR techniques such as advanced LP, ILP, goal programming, dynamic programming, and game theory. 3 hrs (class). PR. IE 141. (1,2)

**IE 143. Stochastic Processes in Industrial Engineering (3).** Analysis of different probabilistic models relevant for the industrial engineering profession. 3 hrs (class). PR. STAT 101. (1,2)

**IE 144. Systems Simulation (3).** Representation and simulation of systems; random number generation; record processing and generation of statistics. 5 hrs (2 class, 3 lab). PR. IE 143 and IE 151. (1,2)

**IE 150. Systems Evaluation (3).** Criteria for evaluation of systems; technological, economic, and human factors. 3 hrs (class). PR. MATH 28 or MATH 38. (1,2)

**IE 151. Production Systems (3).** Planning, implementing and managing production operations within the system. 5 hrs (2 class, 3 lab). PR. IE 125, IE 132, and IE 141. (1,2)

**IE 152. Production Planning and Design (3).** Location and layout of facilities; materials handling, storage and distribution. 5 hrs (2 class, 3 lab). PR. IE 150 and IE 151. (1,2)

**IE 158. Supply Chain Engineering (3).** Concepts, processes and best practices used in design and improvement of supply chains of goods and services. 3 hrs (class). PR. IE 152 or COI (must have taken production management courses). (1,2)

**IE 164. Information Systems I (3).** Analysis and design of information systems. 3 hrs (class). PR. ENSC 26. (1,2)

**IE 165. Information Systems II (3).** Implementation considerations in information systems design; relational database systems. 3 hrs (class). PR. IE 164. (1,2)

**IE 184. Project Development and Management (3).** Phases of project feasibility studies; project development, evaluation and management. 5 hrs (2 class, 3 lab). PR. IE 152 or COI (FPPS 183 or IE 150, and design course of the program). (1,2)

**IE 185. Industrial Systems Design (3).** Total systems design; integration of subsystem with concentration on optimal total systems implementation. 5 hrs (2 class, 3 lab). PR. IE 184. (1,2)

**IE 191. Special Topics (3).** 3 hrs (class). PR. COI (IE 184 and senior standing). (1,2,M)

**IE 198. Internship (3).** PR. COI. (1,2,M)

**IE 199. Undergraduate Seminar (1)**. 1 hr (class). PR. COI (currently taking IE 200/200b/200c). (1,2)

**IE 200. Undergraduate Thesis (6).** PR. COI. (1,2,M)

**IE 200b. Innovationeering (6).** PR. COI. (1,2,M)

**IE 200c. Engineering Industry Research (6).** PR. COI. (1,2,M)

# DEPARTMENT OF MECHANICAL ENGINEERING

## MECHANICAL ENGINEERING

**ME 10. Introduction to Mechanical Engineering (1).** Nature and scope of mechanical engineering; professional and industry opportunities. 1 hr (class). PR. None. (1,2)

**ME 45. Analysis of Machine Elements (3).** Analysis of kinematic and dynamic forces in machine elements. 5 hrs (2 class, 3 comp). ENSC 12. (1,2)

**ME 70. Mechanical Engineering Thermodynamics (3).** Applications of laws of thermodynamics in analysis of working fluids used in power cycles. 3 hrs (class). PR. ENSC 14 and CHEM 18. (1,2)

**ME 90. Mechanical Engineering Laws, Ethics, Codes and Standards (2).** Mechanical Engineering laws, code of ethics, intellectual property rights, technical codes and standards. 2 hrs (class). PR. None. (1,2)

**ME 154. Design of Machinery (3).** Analysis and design of different machine elements for mechanical design application. 5 hrs (2 class, 3 lab). PR. ME 45 and ABE 53. (1,2)

**ME 158. Introduction to Biomechanical Engineering (3).** Concepts of biodynamics and kinematics of human and animal body modeling. 5 hrs (2 class, 3 lab). PR. ME 154. (2)

**ME160. Mechanical Vibrations (3).** Fundamental concepts of vibration affecting the operation and performance of machine components. 3 hrs (3 class). PR. ENSC 12 and ENSC 21. (1,2)

**ME 171. Fluid Machinery (3).** Principles of proper operation, selection and application of commonly used fluid machinery. 3 hrs (class). PR. ENSC 16. (1,2)

**ME 172. Combustion Engineering (2).** Fundamental concepts of combustion, principles of internal and external combustion processes, design concepts of combustion machinery and equipment. 2 hrs (class). PR. ME 70. (1,2)

**ME 173.1. Mechanical Engineering Laboratory I (1).** Experimental methods and measurement techniques involving fuels, lubricants and gases. 3 hrs (lab). PR. ME 172. (1,2)

**ME 174.1. Mechanical Engineering Laboratory II (2).** Study and test of fluid and heat transfer machinery. 6 hrs (lab). PR. ME 171 and ME 173.1. (1,2)

**ME 175. Refrigeration Systems (3).** Analysis of mechanical refrigeration systems. 3 hrs (class). PR. ENSC 15. (1,2)

**ME 176. Air-conditioning and Ventilation Systems (3).** Psychrometric properties, factors, and processes of air, air distribution, air quality and duct design. 3 hrs (class). PR. ME 175. (1,2)

**ME 181. Industrial Plant Engineering and Design (4).** Mechanical engineering theories, equipment, and systems in the design of industrial plants. 6 hrs (3 class, 3 lab). PR. ME 174.1 and ME 176. (1,2)

**ME 182. Power Plant Engineering and Design (4).** Analysis and design of components of power generating plants. 6 hrs (3 class, 3 lab). PR. ME 172. (1,2)

**ME 198. Internship (3).** PR. COI (1,2,M)

**ME 199. Undergraduate Seminar (1).** 1 hr (class). PR. COI. COI will be given to students with Junior Standing. (1,2)

**ME 200. Undergraduate Thesis (6).** PR. COI. (1,2,M)

**ME 200b. Innovationeering (6).** PR. COI. (1,2,M)

**ME 200c. Engineering Industry Research (6).** PR. COI. (1,2,M)

## DEPARTMENT OF MATERIALS ENGINEERING

**MatE 10. Introduction to Materials Engineering (1).** Nature and scope of the materials engineering field. 1 hr (class). PR. None. (1)

**MatE 21. Structure-Property Relationship of Materials I (3).** Structure of metals, ceramics, and polymers; correlation of structure to material properties. 3 hrs (class). PR. CHEM 18 and PHYS 51 or PHYS 71. (1,2)

**MatE 22. Structure-Property Relationship of Materials II (4).** Stress-strain analysis; phase transformations and relation of microstructure to mechanical properties; heat treatment techniques; strengthening mechanisms. 6 hrs (3 class, 3 lab). PR. MatE 21, ENSC 13, and ENSC 21. (1,2)

**MatE 23. Structure-Property Relationship of Materials III (3).** Electrical, thermal, optical, and magnetic properties of materials. 3 hrs (class). PR. MatE 21 and PHYS 72. (1,2)

**MatE 90. Laws and Ethics for Materials Engineers (2).** Code of ethics, contracts, laws, regulations, standards, and issues in relation to the practice of the materials engineering profession. 2 hrs (class). PR. None. Course Stipulation: Senior standing. (1,2)

**MatE 101. Thermodynamics of Materials (4).** Basic thermodynamic quantities and laws; free energy of solutions, surfaces, and interfaces; phase equilibria; construction of equilibrium diagrams. 6 hrs (3 class, 3 lab). PR. MatE 21. (1,2)

**MatE 103. Rate Processes in Materials Engineering (4).** Principles of transport phenomena and reaction kinetics as applied to materials engineering. 6 hrs (3 class, 3 lab). PR. MatE 101 and ENSC 21. (1,2)

**MatE 105. Materials Analysis and Testing (4).** Principles and application of analytical techniques and testing methods for materials characterization. 8 hrs (2 class, 6 lab). PR. CHEM 32, MatE 22, and MatE 23. (1,2)

**MatE 165. Materials Synthesis and Processing (3).** Mechanisms, methods, and equipment involved in materials synthesis. 3 hrs (class). PR. CHEM 40, MatE 103, and MatE 105. (1,2)

**MatE 165.1. Materials Synthesis and Processing Laboratory (2).** Laboratory course on the mechanisms, methods, and equipment involved in materials synthesis. 6 hrs (lab). PR. STAT 162. CoR. MatE 165. (1,2)

**MatE 171. Degradation of Materials (3).** Degradation of materials under different internal and external stimuli; degradation detection and mitigation. 3 hrs (class). PR. None. Course Stipulation: Senior standing. (1)

**MatE 173. Forensic Engineering in Materials (3).** Failure analysis of materials; destructive and non-destructive testing methods; industrial standards for materials. 3 hrs (class). PR. MatE 171. (2)

**MatE 175. Materials Synthesis and Processing (3).** Fabrication techniques including joining and finishing; process parameter specifications. 3 hrs (class). PR. MatE 103 and ENSC 16. (1,2)

**MatE 175.1. Materials Synthesis and Processing Laboratory (2).** Laboratory course on fabrication techniques including joining and finishing; process parameter specifications. 6 hrs (lab). PR. STAT 162. CoR. MatE 175. (1,2)

**MatE 181. Basic Polymer Engineering (3).** Polymer properties, processing, applications, and sustainability. 3 hrs (class). PR. MatE 165 and MatE 175; or COI. (1,2)

**MatE 182. Advanced Ceramic Materials (3).** Survey of processing techniques and applications of advanced ceramic materials. 3 hrs (class). PR. MatE 165 and MatE 175; or COI. (1,2)

**MatE 183. Composite Materials (3).** Properties, fabrication, and functionality of various types of composite materials. 3 hrs (class). PR. MatE 165 and MatE 175; or COI. (1,2)

**MatE 184. Fundamentals of Electrometallurgy (3).** Electrochemical principles and methods involved in electrometallurgical processes. 3 hrs (class). PR. MatE 22 and MatE 103. (1,2)

**MatE 185. Introduction to Microelectronic Fabrication (3).** Processes, challenges, and advances in microelectronic fabrication from a materials engineering perspective. 3 hrs (class). PR. MatE 23 and EE 2 (for BS MatE); or EE 65 (for BS EE). (1,2)

**MatE 186. Advanced Materials Modeling (3).** Key theoretical ideas in multiscale materials modeling. 3 hrs (class). PR. MatE 23 and ENSC 26. (1,2)

**MatE 191. Special Topics (3).** 3 hrs (class). PR. COI. (1,2)

**MatE 198. Internship (3).** PR. COI. (1,2,M)

**MatE 199. Undergraduate Seminar (1).** 1 hr (class). PR. COI. (1,2)

**MatE 200. Undergraduate Thesis (6).** PR. COI. (1,2,M)

**MatE 200b. Innovationeering (6).** PR. COI. (1,2,M)

**MatE 200c. Engineering Industry Research (6).** PR. COI. (1,2,M)

## DEPARTMENT OF ENGINEERING SCIENCE

### ENGINEERING SCIENCE

**ENSC 10.1. Engineering Graphics Laboratory (2).** Advanced drafting operations, techniques and tools; and computer-aided design (CAD). 6 hrs (lab). PR. None. (1,2,M)

**ENSC 11. Statics of Rigid Bodies (3).** Fundamental principles of equilibrium of rigid bodies; analysis of structures; first and second moments of mass, volume, area and length; shear and bending diagrams. 3 hrs (class). PR. MATH 27 and PHYS 51 or PHYS 71. (1,2,M)

**ENSC 12. Dynamics of Rigid Bodies (3).** Kinematics and kinetics of rigid bodies in rectilinear, curvilinear and plane motion; force, mass and acceleration relationships; concepts of work, energy, impulse and momentum; mechanical vibrations. 3 hrs (class). PR. ENSC 11. (1,2,M)

**ENSC 13. Strength of Materials (3).** Elementary stress and strain analysis; analysis and design of structural elements based on equilibrium and material properties. 3 hrs (class). PR. ENSC 11. (1,2,M)

**ENSC 14. Basic Thermodynamics (3).** Fundamental concepts and laws of thermodynamics; thermodynamic properties of substances; thermodynamic processes and cycles. 3 hrs (class). PR. MATH 28 and PHYS 51 or PHYS 71. (1,2)

**ENSC 14a. Engineering Thermodynamics and Heat Transfer (5).** Fundamental concepts and laws of thermodynamics; thermodynamic properties of substances; thermodynamic processes and cycles; principles of heat transfer. 7 hrs (4 class, 3 comp). PR. MATH 28 and PHYS 51 or PHYS 71. (1, 2)

**ENSC 15. Fundamentals of Heat Transfer (3).** Principles of conduction, convection and radiation of heat. 3 hrs (class). PR. ENSC 14. (1,2)

**ENSC 16. Fluid Mechanics (3).** Properties of fluids; fluid statics, kinematics and dynamics; flow in pressure conduits and open channels; fluid measurements and turbomachinery. 3 hrs (class). PR. ENSC 12. (1,2,M)

**ENSC 16.1. Fluid Mechanics Laboratory (2).** Principles of experimental analysis and design in fluid mechanics. 6 hrs (lab). PR. ENSC 16. (2)

**ENSC 21. Mathematical Methods in Engineering (3).** Mathematical treatment of problems in engineering sciences; introduction to ordinary differential equations; Fourier series; Laplace transformation and vector analysis. 3 hrs (class). PR. MATH 28 or MATH 38. (1,2,M)

**ENSC 26. Computer Applications in Engineering (3).** Concepts and methods of programming; applications to engineering problems. 5 hrs (2 class, 3 lab). PR. MATH 28. Course Stipulation: Sophomore standing and must have taken at least one major course. (1,2)