



الجامعة الألمانية الأردنية
German Jordanian University

*School of Sustainable Systems Engineering
Department of Electrical and Energy Engineering*



Study plan

Bachelor of Science (BSc)

Energy Engineering

2021/2022

Vision

The vision of the Energy Engineering Department is to be internationally recognized for excellence in education, pioneering research and in full compliance with international standards of quality assurance.

Mission Statement

The mission of the Energy Engineering Department is to provide high quality education in the multidisciplinary field of Energy Engineering; materialize partnerships with industry by addressing the everchanging market needs for future engineers, while providing students with the knowledge and experience for future professional leadership.

Educational Objectives

- **Objective 1: Technical Knowledge**

Provide the technical knowledge of energy engineering from both the electrical and mechanical engineering aspects and principles, along with the required supporting knowledge of mathematics, science and computing fundamentals. Emphasis is made on the specialty areas of Renewable Energy and Electrical Power.

- **Objective 2: Technical Skills**

Develop the skills needed to perform and design experimental projects. Develop the ability to formulate problems and projects, and to plan a solution process deploying diverse technical knowledge and skills.

- **Objective 3: Communications Skills**

Develop the ability to organize and present information effectively whether orally, written or visual.

- **Objective 4: Preparation for Further Study**

Provide sufficient breadth and depth for successful subsequent graduate study and lifelong learning.

- **Objective 5: Preparation for the Profession**

Provide an appreciation for the broad spectrum of issues arising in professional practice, including teamwork, leadership, safety, ethics, service, economics, and professional organizations.

Program Learning Outcomes

- a) An ability to apply knowledge of mathematics, science and engineering.
- b) An ability to design and conduct experiments, as well as to analyze and interpret data.
- c) An ability to design a system, component, or process to meet desired needs.
- d) An ability to function in teams.
- e) An ability to identify, formulate and solve engineering problems.
- f) An understanding of professional and ethical responsibility.
- g) An ability to communicate effectively.
- h) A broad education necessary to understand the impact of electrical engineering solutions in a global and societal context.
- i) A recognition of the need for an ability to engage in life-long learning.
- j) A knowledge of contemporary issues.
- k) An ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

These constitute the ABET a-k criteria.

ENERGY ENGINEERING CURRICULUM

Course Coding and Numbering

- A five to seven-character code is used to designate courses as in the following table:

Department	Level/Year	Field	Sequence
Two to Four Letters	X (Number)	Y (Number)	Z (Number)

- Therefore, courses in Energy Engineering will have numbers of the form ENE XYZ.
- The Department codes for the course in this study plan:

Code	Department
ARB	Arabic
CHEM	Chemistry
CS	Computer Science
ECE	Electrical and Computer Engineering
ENE	Energy Engineering
ENGL	English
GERL	German

Code	Department
IE	Industrial Engineering
MATH	Mathematics
ME	Mechatronics Engineering
MECH	Mechanical and Maintenance Engineering
MILS	Military Science
NE	National Education
PHYS	Physics

- The middle digit for Energy Engineering courses denotes the course field as in the following table:

Middle Digit	Specialization
0	General Engineering
1	Electrical Engineering
2	Mechanical Engineering
3	Energy Engineering
4	Electrical Power
9	Engineering Training, Graduation Projects, Special Topics

Specializations

The Department of Energy Engineering awards the Bachelor of Science (B.Sc.) degree after successfully passing 179 credit hours. The B.Sc. degree in Energy Engineering can be obtained in one of two specializations: Renewable Energy Engineering and Electrical Power Engineering.

Degree Requirements

Classification	Credit hours
1. University requirements	27
2. School requirements	42
3. Department Requirement	98
4. Study in Germany	12
Total Credit hours	179

List of Courses

Framework for the B.Sc. Degree for the Energy Engineering Department

1. University Requirements (27 Credit Hours)

a. Compulsory (21 Credit Hours)

Course ID	Course Title	Credit Hours	Lecture	Lab	Pre-requisite
ARB099	Arabic 099 *	0	0	3	-
ARB100	Arabic *	3	3	0	-
ENGL098	English I *	0	0	3	-
ENGL099	English II *	0	0	3	ENGL098
ENGL101	English III *	1	0	3	ENGL099
ENGL102	English IV *	1	0	3	ENGL101
ENGL201	English V *	2	0	3	ENGL102
ENGL202	English VI *	2	0	3	ENGL201
GERL101	German I *	3	0	9	-
GERL102	German II	3	0	9	GERL101
NE101	National Education (in Arabic)	3	3	0	ARB 099
	National Education (in English)	3	3	0	ENGL101
MILS100	Military Sciences	3	3	0	Only for Jordanian
Total		21			

*Student's score on placement test will decide the course level to start from

b. University Electives (6 Credit Hours)

Course ID	Course Title	Credit Hours	Lecture	Lab	Pre-requisite
DES101	Arts' Appreciation (in Arabic)	3	3	0	ARB099
	Arts' Appreciation (in English)	3	3	0	ENGL101
PE101	Sports and health	3	3	0	ARB099
EI101	Leadership and Emotional Intelligence	3	3	0	ENGL101
IC101	Intercultural Communication	3	3	0	ENGL101
BE302 OR SE301	Business Entrepreneurship OR Social Entrepreneurship and Enterprises	3 OR 3	3	0	ENGL101
SFTS101	Soft Skills	3	3	0	ENGL101

2. School Requirements (42 Credit Hours)

Course ID	Course Title	Credit Hours	Lecture	Lab	Pre-requisite Or Co-requisite(#)
CHEM103	General Chemistry I	3	3	0	-
CHEM106	General Chemistry lab	1	0	3	#CHEM103
CS116	Computing fundamentals	3	3	0	-
CS 1160	Computing fundamentals lab	1	0	3	#CS116
ENE437	Economics of Natural Resources Engineering	3	3	0	MATH203
GERL201	German III	3	0	9	GERL102
GERL202	German IV	3	0	9	GERL201
IE0121	Probability and Statistics	3	3	0	MATH101
IE0141	Engineering Workshop	1	1	0	-
MATH101	Calculus I	3	3	0	-
MATH102	Calculus II	3	3	0	MATH101
MATH203	Applied Mathematics for Engineers	3	3	0	MATH102 , ARB099 , ENGL099 , MATH099
MATH205	Differential equations	3	3	0	#MATH203 ARB099 , ENGL099 , MATH099
ME0111	Computer Aided Engineering Drawing	2	-	6	CS116
PHYS103	Physics I	3	3	0	-
PHYS104	Physics II	3	3	0	PHYS103
PHYS106	General Physics Lab	1	0	3	#PHYS104
Total		42			

3. Department Requirement & Study in Germany (110 Credit Hours)

a. Compulsory (86 Credit Hours)

Course ID	Course Title	Credit Hours	Lecture	Lab	Pre-requisite Or Co-requisite(#)
GERL301	German V	3	0	9	GERL202
GERL302	German VI	3	0	9	GERL301
ENE211	Electrical Circuits I	3	3	0	PHYS104 MATH102 ARB099 , ENGL099 , MATH099
ENE212	Electrical Circuits II	3	3	0	ENE211, ARB099 , ENGL099 , MATH099
ENE213	Electrical Circuits Lab	1	0	3	ENE211 , ARB099 , ENGL099 , MATH099
ENE214	Electronics	3	3	0	ENE211, ARB099 , ENGL099 , MATH099
ENE215	Electronics Lab	1	0	3	ENE213, ENE214, ARB099 , ENGL099 , MATH099
ECE333	Electromagnetics	3	3	0	MATH203
MECH0221	Thermodynamics	3	3	0	MATH102
MECH0222	Fluid Mechanics	3	3	0	MATH102, PHYS103
ENE301	Introduction to Digital Systems and Microcontrollers	3	2	2	#ENE214
ENE302	Statistical and Numerical Methods for Energy Engineers	3	3	0	MATH205
ENE311	Electrical Machines	3	3	0	ENE212, #ECE333
ENE312	Power Electronics	3	3	0	ENE212, ENE214
ENE313	Electrical Machines Lab	1	0	3	ENE311
ENE314	Power Electronics Lab	1	0	3	ENE312
ENE316	Introduction to Communication Systems for Energy Engineers	3	3	0	ENE212
ENE321	Heat Transfer	3	3	0	MECH0221, MECH0222, MATH205
ENE323	Fluid Mechanics Lab	1	0	3	MECH0222
ENE324	Introduction to Energy Systems	3	3	0	MECH0222
ENE399	Field Training	0	-	-	University Regulations

ME0346	Instrumentations and Measurements	2	2	3	ENE211, MATH205,
ME0347	Instrumentation and Measurements Lab	1	0	3	#ME0346
ENE401	Energy Systems Simulation Lab	1	0	3	ENE324
ENE432	Power Plant Engineering	3	3	0	ENE321
ENE434	PV Technology I	3	3	0	ENE212, ENE214, ENE324
ENE441	Power Systems	3	3	0	ENE302, ENE311
ENE442	Power Systems Lab	1	0	3	ENE441
ENE443	Electrical Power Generation, Transmission & Distribution	3	3	0	ENE441
ENE444	Modeling and Control of Energy Systems	3	3	0	MATH205, ENE311
ENE499	International Internship	12	0	36	ENE399
ENE598	Graduation Project I	1	0	3	ENE499
ENE599	Graduation Project II	3	0	9	ENE598
Total		86			

b. Compulsory Renewable Energy Track (12 Credit Hours)

Course ID	Course Title	Credit Hours	Lecture	Lab	Pre-requisite Or Co-requisite(#)
ENE433	Solar Energy I	3	3	0	ENE324
ENE435	Wind Energy Technology	3	3	0	ENE312, ENE324
ENE436	Renewable Energy lab	1	0	3	ENE324
ENE532	Energy lab	1	0	3	ENE324
ENE537	Energy Efficiency, management and laws	3	3	0	ENE324
ENE536	Energy Efficiency Lab	1	0	3	ENE324
Total		12			

c. Compulsory Electrical Power Track (12 Credit Hours)

Course ID	Course Title	Credit Hours	Lecture	Lab	Pre-requisite Or Co-requisite(#)
ENE445	Electric Drives	3	3	0	ENE312, ENE444
ENE446	Electric Drives Lab	1	0	3	#ENE445
ENE541	Power System Analysis	3	3	0	ENE441
ENE542	Power System Protection	3	3	0	#ENE541
ENE543	Power System Protection Lab	1	0	3	#ENE542
ENE544	Power Systems Integrations Lab	1	0	3	ENE301, ENE314, ENE442
Total		12			

d. Elective Renewable Energy Track (12 Credit Hours)

Course ID	Course Title	Credit Hours	Pre-requisite
ENE520	Thermal Energy Storage	3	BSC001
ENE521	Thermal and Hydrodynamic equipment	3	BSC001
ENE524	Geothermal and Hydropower systems	3	BSC001
ENE525	Fuel Cell & Hydrogen Production Technology	3	BSC001
ENE526	Bio-Energy Technology	3	BSC001
ENE527	Techno-economics of energy systems	3	BSC001
ENE528	Applied Refrigeration	3	BSC001
ENE529	Modeling and Simulation	3	BSC001
ENE530	Advanced Renewable Energy Systems	3	BSC001
ENE531	Environmental and Energy Engineering	3	BSC001
ENE533	Solar Energy II	3	BSC001
ENE534	Low Carbon Buildings	3	BSC001
ENE535	PV Technology II	3	BSC001
ENE539	Energy Audit	3	BSC001
ENE522	Heating Ventilating and Air Conditioning (HVAC)	3	BSC001
ENE523	Turbomachinery	3	BSC001
ENE595-A	Special Topics	1	BSC001
ENE595-B	Special Topics	2	BSC001
ENE595-C	Special Topics	3	BSC001
EE3104	Artificial Intelligence in Electrical and Energy Systems	3	BSC001
EE3401	Communication Systems and IoT Protocols	3	BSC001
EE4107	Special Topics in Electrical Systems	3	BSC001
EE4204	Power Systems Operation and Control	3	BSC001
EE4216	Special Topics in Power Systems	3	BSC001

EE4319	Special Topics Renewable Energy	3	BSC001
EE4318	Data Analytics for Power and Energy Systems	3	BSC001
BIDA4100	Artificial Intelligence and Machine Learning for Business	3	BSC001
CE377	Machine Learning	3	BSC001
CE441	Embedded System Design	3	BSC001
CEE553	Building Physics	3	BSC001
CEE572	Environmental and Water Law and Policy	3	BSC001
CEE596	Advanced topics in Project Management	3	BSC001
IE0417	Business and Labor Law	3	BSC001
IE0515	Product Development and Entrepreneurship	3	BSC001
IE0516	Facilities and Asset Management	3	BSC001
IE0533	Supply Chain Engineering	3	BSC001
IE0562	Industrial Cost Analysis	3	BSC001
MECH0552	Management of Maintenance Systems	3	BSC001
MECH4214	Thermal Management of Electronic Systems	3	BSC001
MECH4407	Failure Analysis	3	BSC001
MECH4410	Six Sigma	3	BSC001
MECH5501	Heating Ventilation and Air Conditioning	3	BSC001
MECH5606	Hybrid and Electric Vehicles	3	BSC001
MGT418	Quality Management	3	BSC001

e. Elective Electrical Power Track (12 Credit Hours)

Course ID	Course Title	Credit Hours	Pre-requisite
ENE511	Power Semiconductor Devices	3	BSC001
ENE512	Special Electrical Machines	3	BSC001
ENE513	Electronic Circuit Design	3	BSC001
ENE514	Mixed Signal Test Engineering	3	BSC001
ENE515	Electrochemical Energy Storage	3	BSC001
ENE516	Smart-Grids	3	BSC001
ENE517	Switched Mode Power Supplies	3	BSC001
ENE545	Power System Quality	3	BSC001
ENE546	High Voltage Engineering	3	BSC001
ENE547	Power Electronic Applications in Power Systems	3	BSC001
ENE548	Power System Stability	3	BSC001
ENE549	Power System Reliability	3	BSC001
ENE595-A	Special Topics	1	BSC001

ENE595-B	Special Topics	2	BSC001
ENE595-C	Special Topics	3	BSC001
EE3104	Artificial Intelligence in Electrical and Energy Systems	3	BSC001
EE3401	Communication Systems and IoT Protocols	3	BSC001
EE4107	Special Topics in Electrical Systems	3	BSC001
EE4204	Power Systems Operation and Control	3	BSC001
EE4216	Special Topics in Power Systems	3	BSC001
EE4319	Special Topics Renewable Energy	3	BSC001
EE4318	Data Analytics for Power and Energy Systems	3	BSC001
BIDA4100	Artificial Intelligence and Machine Learning for Business	3	BSC001
CE377	Machine Learning	3	BSC001
CE441	Embedded System Design	3	BSC001
CEE553	Building Physics	3	BSC001
CEE572	Environmental and Water Law and Policy	3	BSC001
CEE596	Advanced topics in Project Management	3	BSC001
IE0417	Business and Labor Law	3	BSC001
IE0515	Product Development and Entrepreneurship	3	BSC001
IE0516	Facilities and Asset Management	3	BSC001
IE0533	Supply Chain Engineering	3	BSC001
IE0562	Industrial Cost Analysis	3	BSC001
MECH0552	Management of Maintenance Systems	3	BSC001
MECH4214	Thermal Management of Electronic Systems	3	BSC001
MECH4407	Failure Analysis	3	BSC001
MECH4410	Six Sigma	3	BSC001
MECH5501	Heating Ventilation and Air Conditioning	3	BSC001
MECH5606	Hybrid and Electric Vehicles	3	BSC001
MGT418	Quality Management	3	BSC001

CATALOGUE DESCRIPTION OF ENERGY ENGINEERING COURSES

ENE211 Electrical Circuits I (3CH) (Pre-requisite: PHYS 104 , MATH102)

SI units, voltage and current; Ohm's and Kirchhoff's Laws, circuits with dependent sources; simple resistive circuits: series, parallel and delta to wye; techniques of circuit analysis: nodal and mesh analyses, source transformation, Thevenin and Norton equivalents; amplifiers; inductance, capacitance and mutual inductance; natural and step responses of RL and RC circuits; natural and step response of series and parallel RLC circuits; sinusoidal steady state analysis.

ENE212 Electrical Circuits II (3CH) (Pre-requisite: ENE211)

average, reactive and complex power, power measurements; polyphase circuits, mutual inductances; Laplace Transforms, frequency response, impulse and step response, passive and active filters, Fourier series and the Fourier Transform, two-port circuits.

ENE213 Electrical Circuits Lab (1CH) (Pre-requisite: ENE211)

resistive circuits, potentiometers, superposition, Thevenin theorem, maximum power transfer, RLC current and voltage characteristics, frequency response of RL and RC circuits, series and parallel resonant circuits.

ENE214 Electronics (3CH) (Pre-requisite: ENE211)

semiconductor material, covalent bond model, doping, PN junction, the diode (IV-characteristics, reverse behavior, zero and forward biasing, ideal and real diode), Zener diode, Schottky diode, diode circuit analysis, half-wave rectifier circuits, full-wave rectifier circuits, dynamic switching behavior of the diode, diode applications, Bipolar Junction Transistor (BJT) (NPN and PNP transistors, iv-characteristics, DC analysis (Q-point) & AC small-signal analysis), Field- Effect Transistors (FETs) (Junction FET (JFET) transistor, Metal-Oxide Semiconductor FET (MOSFET) transistor) and i-v characteristics of FET transistors, DC analysis (Q-point) & AC small-signal analysis. Ideal Operational Amplifiers (Op-amps) and their applications.

ENE215 Electronics Lab (1CH) (Pre-requisite: ENE213, ENE214)

diode circuits, DC and AC characteristics of BJT and FET amplifiers, operational amplifiers and applications, Lab project.

ENE301 Introduction to Digital System and Microcontrollers (3CH) (Co-requisite: ENE214)

Combinational and sequential circuit design using Boolean algebra and Karnaugh Maps, digital circuit design using random logic gates, interfacing circuits, interrupt signals and routines, analog and digital peripherals programming: digital I/Os, timers, ADC, Low power modes of operation and application of microcontrollers.

ENE302 Statistical and Numerical Methods for Energy Engineers (3CH) (Pre-requisite: MATH205)

introduction to MatLab, error analysis, interpolation, extrapolation, curve-fitting, solving systems of linear equations, root-finding for non-linear equations, numerical differentiation and integration, numerical solutions to ordinary differential equations.

ENE311 Electrical Machines (3CH) (Pre-requisite: ENE212 , Co-requisite: ECE333)

transformers: performance characteristics, three-phase connections, autotransformers; DC machines: performance equations, generator and motor characteristics, starting and speed control of motors; single phase induction motors; three-phase induction motors: operation, performance calculations, starting and speed control; synchronous machines: generator and motor operation; small synchronous motors; universal motors;

ENE312 Power Electronics (3CH) (Pre-requisite: ENE212, ENE214)

power semiconductor devices: types, drive circuits, protection circuits, and power loss calculation; AC-DC converters: uncontrolled and fully-controlled single-phase and three-phase rectifiers, half-controlled rectifiers; DC-DC converters: step-down, step-up, and step-down/up converters; DC-AC converters: single-phase and three-phase inverters; AC-AC converters: cycloconverters, ac voltage controllers.

ENE313 Electrical Machines Lab (1CH) (Pre-requisite: ENE311)

transformers, three-phase transformer methods of connection, DC motors, DC generators, three-phase induction motors, single-phase induction motors, three-phase synchronous generator and motor, AC series motor, lab project.

ENE314 Power Electronics Lab (1CH) (Pre-requisite: ENE312)

uncontrolled single phase half wave rectifier, uncontrolled single phase full wave rectifier, uncontrolled three phase rectifiers, controlled single phase rectifiers, controlled three phase rectifiers, DC chopper (buck converter), DC chopper (boost converter), DC chopper (buck boost converter), single phase AC inverter, lab project.

ENE316 Introduction to Communication Systems for Energy Engineers (Pre-requisite: ENE212)

equivalent low-pass models, AM modulation and demodulation, FM modulation and demodulation, sampling and quantization, pulse width modulation, tuned circuits and crystals, light emitting diodes, optoelectronics integrated circuits.

ENE321 Heat Transfer (3CH) (Pre-requisite: MECH0221, MECH0222, MATH205)

conduction: steady state (1D and 2-D), transient state; convection: forced (external and internal), natural convection and heat exchangers; radiation: black body radiation, radiative properties, shape factors and gray surfaces radiation.

ENE324 Introduction to Energy Systems (3CH) (Pre-requisite: MECH0222)

thermodynamic, mechanical, and electrical aspects of modern energy conversion systems; traditional systems (steam electric power plants, gas turbines, internal combustion engines, refrigeration systems); renewable systems (solar, wind, geothermal); combined heat and power and co-generation; economic and environmental aspects of energy conversion.

ENE323 Fluid Mechanics Lab (1CH) (Pre-requisite: MECH0222)

fluid properties: density, specific gravity, viscosity; fluid characteristics; continuity, conservation of energy; fluid behavior: center of pressure, pipe flow, open channel flow; and pump performance.

ENE399 Field Training (0CH) (Pre-requisite:)

University Regulations;

ENE401 Energy Systems Simulation Lab(1CH) (Pre-requisite: ENE324)

Mathematical and algebraic modeling, linear programming, programming and simulation of Power Systems, renewable energy systems, energy economy modelling.

ENE445 Electric Drive (3CH) (Pre-requisite: ENE312, ENE444)

DC-motor drives using controlled AC-DC converters; DC-motor drives using DC-DC converters; frequency-controlled induction-motor drives; slip energy recovery; synchronous motor drives using inverters and cycloconverters; variable reluctance drives: switched reluctance and stepper-motor drives using bridge inverters.

ENE446 Electric Drive Lab (1CH) (Co-requisite: ENE445)

DC-motor drives using controlled AC-DC converters, DC-motor drives using DC-DC converters, Frequency-controlled Induction-motor drives, Synchronous motor drives using inverters and cycloconverters.

ENE432 Power Plant Engineering (3CH) (Pre-requisite: ENE321)

introduction to power plants engineering, energy: A Measure for work potential, gas power cycles, vapor and combined power cycles, thermal power plant components, steam and gas turbine, steam generators, condenser and condensate, feed-water systems compressors, pumps.

ENE433 Solar Energy I (3CH) (Pre-requisite: ENE324)

heat transfer phenomena (radiation, convection, conduction) in solar thermal systems; materials used in solar thermal applications and their properties: selective treatments, phase change materials, transparent insulating surfaces; design methodologies and calculation of solar thermal systems and equipment; heat transfer calculation software; testing of solar thermal collectors and solar thermal systems; applications of solar energy: absorption cooling systems, solar thermal energy system as a primary source of electricity; solar thermal concentration (solar thermo-electric).

ENE434 PV Technology I (3CH) (Pre-requisite: ENE212, ENE214, and ENE324)

characteristics of sunlight and types of solar irradiance, sun position calculator, solar radiation potential assessment with fixed inclination (tilt) and orientation (azimuth) angles; semiconductor and silicon PN junction photovoltaic (PV) cells; Photovoltaic (PV) effect of silicon solar cells; the behavior and performance of silicon PV cells; PV cell properties and design; IV-characteristics of ideal and real PV cells; ideal silicon cell IV-curve equation and modelling; real silicon cell equation; PV cells interconnections and fabrication of wafer based and thin-film PV modules; datasheets of commercial PV modules; PV power system components: PV battery charge controllers, DC/AC inverters and batteries; datasheets of PV charge controllers, inverters and batteries; PV mounting structures; electrical single line diagram and module arrangement layout; design and sizing of off-grid/standalone PV systems; design and sizing of on-grid/grid-connected PV systems; Specific Energy Yield (SEY) and Performance Ratio (PR) of grid-connected PV systems; economics of PV systems (time value of money, capital cost, savings, simple payback period, return on investment and internal rate of return).

ENE435 Wind Energy Technology (3CH) (Pre-requisite: ENE312, and ENE324)

Introduction to Wind energy technology, basic characteristics of wind, site characterization statistical methods of wind analysis, wind resources assessment, fundamental principles of wind turbines, aerodynamics, mechanical and electrical components of wind turbines, performance analysis of wind turbines/farms, wind turbines integrations into power systems, environmental and social impact of wind technology, economics of wind technology.

ENE436 Renewable Energy Lab (1CH) (Pre-requisite: ENE324)

assessment of the viability of a wind power, solar radiation, solar thermal, PV or biomass system for a given site; measurement and data collection techniques; analyzing and evaluation these renewable energy resources and calculate savings fractions, backup energy needs, financing options, and economic analyses; the principles of solar home design, solar hot water, and space heating and solar cooling for both new and existing construction; investigation of the potentials of renewable energy technologies to help solve environmental and economic problems within society.

ENE437 Economics of Natural Resources Engineering (1CH) (Pre-requisite: MATH203)

introduction to engineering economy, importance of engineering economics, price elasticity and its application, cost concepts and design economics, cost-estimation techniques, the time value of money, evaluating a single project, comparison and selection among alternatives, depreciation and income taxes, climate change and energy-related environmental externalities.

ENE532 Energy Lab (1CH) (Pre-requisite: ENE324)

data measurements, collection, analysis, evaluation and basic fabrications techniques for major renewable energy systems such as: wind energy, PV and solar thermal, biomass and hydro systems; sizing for each system and calculate predicted energy yield; feasibility for specific locations;

ENE441 Power Systems (3CH) (Pre-requisite: ENE302, ENE311)

introduction to power systems, transformers, series impedance of transmission lines, capacitance of transmission lines, current and voltage relations on a transmission line, impedance and admittance models and network calculations, Gauss-Seidel and Newton-Raphson methods to solve nonlinear algebraic equations, power flow, symmetrical faults.

ENE442 Power Systems Lab (1CH) (Pre-requisite: ENE441)

transmission line performance under different operating conditions, load characteristics, real and reactive power flow and control for a transmission line, characteristics of different types of sequence components, balanced and unbalanced faults, power system transients and stability.

ENE443 Electrical Power Generation, Transmission and Distribution (3CH) (Pre-requisite: ENE441)

substation design, distribution systems, transmission systems, transformers, high voltage cables, introduction to power system protection, circuit breakers, switch gear, introduction to power quality, wiring and grounding.

ENE444 Modeling and Control of Energy Systems (3CH) (Pre-requisite: MATH205, ENE311)

Transfer functions, Block diagrams, Signal flow graphs, State-space description, Mathematical modeling of physical systems, Time-domain analysis, Root locus techniques, Frequency-domain analysis and design, Compensation design, closed loop control of electrical systems, resonant systems.

ENE499 International Internship (12CH) (Pre-requisite: ENE399)

University Regulations.

ENE511 Power Semiconductor Devices (3CH) (Pre-requisite: BSC001)

carrier transport physics, breakdown phenomenon in semiconductor devices, power bipolar transistors, thyristors, power Junction Field-Effect Transistors (JFET), power diodes, power Metal-Oxide-Semiconductor Field-Effect Transistors (MOSFET), power MOS-bipolar devices.

ENE512 Special Electrical Machines (3CH) (Pre-requisite: ENE311)

linear Electric machines: comparison with rotating machines; linear induction motors: simplified electromagnetic field theory, force equation, characteristics; superconducting AC generators and motors; variable reluctance motors: performance and characteristics; printed circuit motors.

ENE513 Electronic Circuit Design (3CH) (Pre-requisite: BSC001)

feedback amplifiers, oscillators, power amplifiers, current mirrors, active loads, differential amplifiers, active filters, internal structure of operational amplifiers, integrated analog circuits and applications.

ENE514 Mixed Signal Test Engineering (3CH) (Pre-requisite: ENE301, ME 0346)

mixed signal testing, the test specification process, DC and parametric measurements, measurement accuracy, tester hardware, sampling theory, DSP-based testing, analog channel testing, digital channel testing, design for test, data analysis, test economics.

ENE515 Electrochemical Energy Storage (3CH) (Pre-requisite: ENE324)

electrochemical energy storing technologies with emphasis on: supercapacitors, batteries, electrode materials, power and energy density, electrochemical characterization techniques, different cell setups.

ENE516 Smart-Grids (3CH) (Pre-requisite: ENE312, ENE316, ENE441)

This course presents a new concept in power systems, by integrating Power systems with Power electronics, Communications and information technology. In addition, the concept of involving intelligent control using SCADA system will be presented.

ENE517 Switched Mode Power Supplies (3CH) (Pre-requisite: ENE312)

power capabilities and switching speeds of power semiconductors; DC-DC switched-mode converters: types, design, control, applications; DC-AC switched-mode inverters: types, design, control of AC output, applications; computer simulation of switched-mode converters.

ENE521 Thermal and Hydrodynamic equipment (3CH) (Pre-requisite: BSC001)

thermal and hydrodynamic equipment design, operation, maintenance and selection of flowing items: boilers, heat exchangers, piping system and fitting, burners, pumps; for this equipment.

ENE522 Heating Ventilating and Air Conditioning (HVAC) (3CH) (Pre-requisite: BSC001)

psychrometric principles, thermal comfort, air conditioning processes, inside and outside design conditions, heating load calculations, infiltration, cooling load calculations, solar gain, design of heating and air conditioning systems, HVAC equipment and components.

ENE523 Turbomachinery (3CH) (Pre-requisite: BSC001)

impulse and reaction turbines, velocity diagrams, energy equations and degree of reaction, total pressure correlation, turbine design, three-dimensional analysis, free vortex design, estimation of stage and design point performance.

ENE524 Geothermal and Hydropower systems (3CH) (Pre-requisite:BSC001)

geothermal systems: geothermal exploration techniques, drilling techniques and logging methods, reservoir physics, well test analysis, monitoring & forecasting, direct and indirect use of geothermal resources, visualization and modeling techniques, design, sizing, analysis and environmental impacts of geothermal systems (geothermal power plants and its types and heat pump systems; hydropower systems: hydropower systems including mini, small and large scale plants; general overview of types of hydropower plants, planning, assessment of hydropower resources, dam design, mechanical and electrical equipment, economic analysis of hydropower plant and the environmental impacts.

ENE525 Fuel Cell & Hydrogen Production Technology (3CH) (Pre-requisite: BSC001)

fundamentals of fuel cells & hydrogen production technology, basic structure of fuel cells, operations and conversion of chemical potential energy into electrical energy, evaluation of the cell performance, and characterization.

ENE526 Bio-Energy Technology (3CH) (Pre-requisite: BSC001)

Introduction to biomass; low-carbon energy systems including: biopower, bioheat and biofuels; scientific examination of feedstock conversion technologies and scale up for industrial production, end products, and their applications; concepts of sustainability, Life Cycle Analysis (LCA) ; bioenergy systems; advantages of low-carbon energy in developing a low-carbon economy and society.

ENE527 Techno-economics of energy systems (3CH) (Pre-requisite: BSC001)

economic competitiveness of renewable energy systems for utility scale electric generation systems, design parameters for the installation and operation of photovoltaic and wind energy systems, building-integrated applications of renewable energy sources, design methodologies of hybrid systems, techno-economic feasibility, funding resources and positive environmental impact assessment for energy saving systems, energy storage technology selection, energy consumption analysis and assessment of energy saving potential and development of energy saving recommendations.

ENE528 Applied Refrigeration (3CH) (Pre-requisite: BSC001)

vapor compression cycle; alternative cycles: absorption cycle, multiple effect cycles, ejector cycles, expansion cycles, electric and magnetic cycles; refrigerants: the properties, refrigerant mixtures, refrigeration system components.

ENE529 Modeling and Simulation (3CH) (Pre-requisite: BSC001)

Modeling techniques of system's Components. Simulation techniques of Systems. This course introduces the basic deterministic optimization techniques which includes LaGrange multiplies, search method, linear and dynamic programming. These techniques are applied to energy-related problems. Moreover, Simulation techniques related to thermal and electrical systems are introduced.

ENE531 Environmental and Energy Engineering (3CH) (Pre-requisite: ENE324)

environmental issues associated with human activity; mass and energy transfer, environmental chemistry, water and air pollution, pollutant transport modeling, pollution management, and risk assessment, and global atmospheric change; physical, chemical, and biological systems relating to the quality of water, land and air environments; topics relating energy to environmental engineering including: carbon production, heat and energy transfer and thermal pollution.

ENE530 Advanced Renewable Energy Systems (3CH) (Pre-requisite: ENE324)

analysis of alternative and renewable energy systems; methods of integrating these solutions with society; sustainable energy; principles, possibilities, and limits of alternative and renewable energy.

ENE533 Solar Energy II (3CH) (Pre-requisite: BSC001)

design of solar thermal and solar photovoltaic power generating units in various modes, financial and related environmental implications, case studies and actual application of available software for design of solar power systems.

ENE534 Low Carbon Buildings (3CH) (Pre-requisite: BSC001)

low carbon buildings; methods for balancing architectural and human requirements; relationship between building design and: thermal comfort inside the building, lighting performance, heating, cooling and lighting loads; psychrometric chart to analyze climate and human comfort; the effects of common passive solar strategies on building design; different thermal comfort models; determine the thermal and lighting performance of a building using manual methods and software; appropriate passive solar and low energy design strategies; assess solar access at a site using manual methods; energy assessment tools for building simulation; energy efficiency techniques in the residential sector.

ENE535 PV Technology II (3CH) (Pre-requisite: BSC001)

solar radiation basics; PV technology basics; emerging PV technologies: Building Integrated PV (BIPV) and Concentrated PV system (CPV); PV tracking systems: 1-axis and 2-axis; PV system types (on-grid and off-grid); testing and commission of PV systems; maintenance of PV systems; large-scale PV systems planning, design and sizing; hybrid systems planning, design and sizing; PV grid connection requirements and codes; construction and installation of PV systems; cost breakdown of PV systems; tender documents preparation for PV systems; technical and financial evaluation of PV tenders; economics of PV systems.

ENE520 Thermal Energy Storage (3CH) (Pre-requisite: BSC001)

energy storage technologies with emphasis on thermal energies storage, energy storage strategies for system optimization, sensible heat, latent heat, inorganic phase change materials, organic phase change materials, Quasi-latent heat, heat pumps.

ENE537 Energy Efficiency, Management and Laws (3CH) (Pre-requisite: ENE324)

technical and physical processes involved in energy usage in: residential, commercial, industrial and transport sectors; economic tools required to justify expenditure on energy efficiency programs; “whole system” design and analysis; policy and environmental requirements to enhance implementation of energy efficiency measures;

ENE536 Energy Efficiency Lab (1CH) (Pre-requisite: ENE324)

Energy efficiency in existing buildings in terms of: energy use, indoor comfort, use, technical and economic feasibility, cultural values; system perspectives such as: energy supply and environmental aspects; energy simulations in buildings; peer critique; energy efficiency measures for apartment buildings evaluation.

ENE539 Energy Audit (3CH) (Pre-requisite: BSC001)

lighting fundamentals, energy utilities and rates, and identification of opportunities for efficiency changes in buildings. Topics include scientific principles of energy, light and heat, energy codes and standards, metering and monitoring. Students will examine the economic, regulatory, and infrastructure issues affecting implementation of energy efficiency measures as well as their potential for solving energy and environmental problems.

ENE541 Power System Analysis (3CH) (Pre-requisite: ENE441)

fault analysis, symmetrical components, unsymmetrical faults, transient stability, economic dispatch and operation.

ENE542 Power System Protection (3CH) (Co-requisite: ENE541)

power system protection, fault analysis, instrument transformers, overcurrent protection, distance protection, differential protection, pilot protection, generator protection, motor protection, transmission line protection, transformer protection, bus protection, radial reactor and shunt capacitor protection.

ENE543 Power System Protection Lab (1CH) (Co-requisite: ENE542)

protective relaying, fuses, time overcurrent relays, instantaneous relays, differential relaying for transformers, distance relaying, current and voltage transformers.

ENE544 Power System Integrations Lab (1CH) (Pre-requisite: ENE301, ENE314, ENE442)

application and integration of hardware and software techniques for modern power systems.

ENE545 Power System Quality (3CH) (Pre-requisite: ENE441)

power quality concepts, wiring and grounding issues, voltage sags, voltage variations, transients, harmonics, longer duration voltage variation, distributed generation and power electronics, instrumentation and analyzers.

ENE546 High Voltage Engineering (3CH) (Pre-requisite: ENE441)

generation and measurement of high voltage, electrostatic field and field stress control, electrical breakdown in gases, solids and liquids, non-destructive insulation test techniques, over-voltages and insulation coordination.

ENE547 Power Electronic Applications in Power Systems (3CH) (Pre-requisite: ENE312)

semiconductor devices for power engineering applications, common power electronic circuits, impact of power electronics loads on power quality, HVDC converter plant, transmission plant control strategies, flexible AC transmission: conventional and advanced devices, shunt compensation, static VAR compensation, series compensation, angle compensation, quadrature boosters, unified power flow controller.

ENE548 Power System Stability (3CH) (Pre-requisite: ENE541)

power system stability concepts, the classical machine model, modeling of synchronous machines, modeling of loads, excitation system types, dynamic models of excitation system, response of a power network to disturbances, small signal stability, voltage stability.

ENE549 Power System Reliability (3CH) (Pre-requisite: ENE541)

power system reliability concepts, modern random processes methods, the universal generating function method, Monte Carlo simulation, reliability of generation systems, reliability assessment of transmission lines, reliability assessment of transformers, and reliability of distribution systems.

ENE595-A Special Topics (1 CH) (Pre-requisite: -BSC001)

This course covers selected special topics in the field of energy.

ENE595-B Special Topics (2 CH) (Pre-requisite: -BSC001)

This course covers selected special topics in the field of energy.

ENE595-C Special Topics (3 CH) (Pre-requisite: -BSC001)

This course covers selected special topics in the field of energy.

ENE598 Graduation Project I (1CH) (Pre-requisite: ENE499)

project preparation by forming teams supervised by faculty member, selecting the project scope; understand the theory, background and application; understand the ethical and professional issues in engineering practice; final presentation and report are required.

ENE599 Graduation Project II (3CH) (Pre-requisite: ENE598)

practical implementation of the project approved in the first portion of the graduation project sequence; a final report and presentation are required.

CATALOGUE DESCRIPTION OF COURSES TAUGHT BY OTHER DEPARTMENTS

ARB0099 Elementary Arabic (3CH) (Pre-requisite: - Placement Test)

This course aims to develop student's ability to read, comprehend, literary analyze, grammatically analyze, linguistically analyze, poetically analyze, and rhetorically analyze texts properly. The course also includes a selection of Arabic literature in poetry and prose representing different literary ages, in addition to several common forms of writing such as scientific article, news article, and others.

ARB 100 Arabic (3CH) (Pre-requisite: -)

Grammar and structure. Rectifying weakness in linguistic application; training in sound reading. Dictation; use of language in a manner free from grammatical and linguistic errors; accurate expression of intended meaning. Study and analysis of literary texts through the discussion of linguistic, grammatical and writing skills therein.

BIDA4100 Artificial Intelligence and Machine Learning for Business (3CH) (Pre-requisite: - BSC001)

This course is designed to help business students to explore Machine Learning (ML) and Artificial Intelligence (AI). Through an algorithmic approach, the students are given a practical understanding of the methods being taught, through making their own implementations of some of the methods. The course covers supervised classification based on e.g., artificial neural networks (deep learning), as well as unsupervised learning (clustering), optimization (evolutionary algorithms and other search methods) and reinforcement learning, in addition to design of experiments and evaluation

CHEM 103 General Chemistry I (3CH) (Pre-requisite: -)

Stoichiometry of formulas and equations. Gases and the kinetic-molecular theory. Quantum theory and atomic structure. The components of matter. The major classes of chemical reactions (precipitation, acid-base, oxidation-reduction, and reversible reactions). Thermodynamics: energy flow and chemical change. Quantum theory and atomic structure. Electron configurations and chemical periodicity. Kinetics: rates and mechanisms of chemical reactions. Equilibrium: The extent of chemical reactions. Acid-base equilibria.

CHEM 106 General Chemistry lab (1CH) (Co-requisite: CHEM 103)

Performing Chemical Experiments based on the general chemistry course.

CE377 Machine Learning (3CH) (Pre-requisite: - BSC001)

In this course, students will be introduced to the fundamental principles, techniques, and practical applications of machine learning. It encompasses both the theoretical foundations and hands-on implementations, enabling students to build a strong foundation in this transformative field. Throughout this course, students will delve into an in-depth exploration of a wide array of machine learning models, unraveling the intricacies of their implementation and showcasing their extensive applications. Machine learning models serve as valuable tools across various domains, including data mining, the creation of analytical models, and their relevance in fields such as security, scientific research, education, healthcare, and more. Our primary objective is to empower students with the knowledge and skills necessary to comprehend the diverse landscape of machine learning models, understand their theoretical foundations, and effectively apply them within the realm of engineering across a variety of domains. Students will apply their knowledge of machine learning techniques using Python to solve real-world predictive analysis problems. They will work on a series of hands-on assignments and projects that cover various aspects of machine learning, including data pre-processing, feature engineering, model selection, and evaluation. Students will have gained practical experience in building and evaluating machine learning models to make data-driven predictions and decisions.

CE441 Embedded System Design (3CH) (Pre-requisite: - BSC001)

Embedded system concepts, hardware architecture, design and debugging, embedded processor selection, software development methodologies, real-time Linux, synchronization mechanisms, interrupt latency, application programming interface, interrupt service routine, application design considerations.

CEE553 Building Physics (3CH) (Pre-requisite: - BSC001)

This course introduces the fundamentals of building physics with a focus on heat, air, light, and moisture transfer in the built environment. Topics include thermal comfort, energy efficiency, insulation, ventilation, acoustics, and daylighting. Students will learn to analyze building performance, evaluate sustainable design strategies, and apply building physics principles to improve occupant comfort and reduce environmental impact. Case studies and practical examples connect theory with real-world building design and operation.

CEE572 Environmental and Water Law and Policy (3CH) (Pre-requisite: - BSC001)

An overview of the history and current application of laws and rules used to protect the environment. This course outlines the general framework of legislation and includes specific discussions of regulations as they are enforced at international, national, state and local levels. The Environmental Regulations course is concerned with Industry and its relationship with the environment and community and the impact of environmental regulations on Industry decision-making. Topics include waste minimization, pollution prevention, hazardous, special, industrial and municipal solid waste control, the Clean Air Act, and Clean Water Act, and the Occupational Safety and Health Act and how it relates to environmental regulations. Act and how it relates to environmental regulations.

CEE596 Advanced topics in Project Management (3CH) (Pre-requisite: - BSC001)

The course requires candidates to study in detail the way in which the principles of the whole project life cycle including design, production and operation in construction can be integrated. It embraces study of the general principles of systems integration and their application in a construction manufacture context. It also entails study of the fundamental principles of simultaneous engineering and addresses the issue of integration through a technology driven approach; and any advanced topic in project management the instructor may choose.

CS116 Computing Fundamentals (3CH)

Basic computer skills, programming concepts, algorithms, variables and data types; arithmetic, logical, relational, Boolean, and assignment operators; simple input and output statements, selection structures, loop structures, single and multidimensional arrays, character strings, functions, data structures, pointers, input/output file operations.

CS1160 Computing Fundamentals Lab (1CH) (Co-requisite: CS 116)

Lab session every week to offer hands-on experience on the topics that are covered in CS116, which are: algorithms, variables and data types; arithmetic, logical, relational, Boolean, and assignment operators; simple input and output statements, selection structures, loop structures, single and multidimensional arrays, character strings, functions, data structures, pointers, input/output file operations.

ENGL 098 English I (0CH) (Pre-requisite: -)

Students will focus on English at an elementary level concentrating on the receptive skills of reading and listening, and the productive skills of writing and speaking. These will include such things as independent clauses, verb tenses, model verbs, adverbs, short dialogues, reading simple material and answering short questions, writing short meaningful sentences, listening to short conversations.

ENGL 099 English II (0CH) (Pre-requisite: ENGL 098)

Students will focus on English at a pre intermediate level concentrating on the receptive skills of reading and listening and the productive skills of writing and speaking. These will include such things as comparatives and superlatives, quantifiers, possessive adjectives and pronouns, vocabulary building, roleplay activities for speaking, reading comprehension and writing short descriptive paragraphs.

ENGL101 English III (1CH) (Pre-requisite: ENGL 099)

Students will focus on English at an intermediate level concentrating on the receptive skills of reading and listening and the productive skills of writing and speaking. These will include collocations, tense review, affirmative, negative statements, synonyms and antonyms, time clauses, conditionals, active and passive forms, reported speech, phrasal verbs, reading comprehension with detailed questions, vocabulary and writing developed descriptive and opinion essays.

ENGL102 English IV (1CH) (Pre-requisite: ENGL101)

Students will focus on English at an upper intermediate level concentrating on the receptive skills of reading and listening and the productive skills of writing and speaking. Model verb review, silent letters and proper pronunciation, jobs and careers, requests and offers, more phrasal verbs with vocabulary building, relative clauses and relative pronouns, narrative tenses for writing exercises, wishes and regrets, reading and comprehending longer passages with direct and inference questions of medium difficulty, hypothesizing, and writing fully developed descriptive, argumentative and analytical essays of 350 words.

ENGL201 English V (2CH) (Pre-requisite: ENGL102)

Students will focus on English at an Advanced level. Students will analyze and produce 2 – 3 page essays with an emphasis on argumentation and persuasion working both independently and cooperatively to gather, evaluate, and synthesize necessary information. Class activities include interactive lectures, small group and class discussions, informal debates, peer feedback, individual presentations, focused listening exercises and focused viewing exercises as well as assorted reading, writing, and grammar assignments. There will be some poetry

analysis together with reading and understanding a short story and a drama using basic literary terms and concepts.

ENGL202 English VI (2CH) (Pre-requisite: ENGL201)

Students will continue to focus on English at an Advanced level. Students will analyze and produce 4 – 5 page essays emphasizing argumentative, persuasive and discursive styles of writing, working both independently and cooperatively to gather, evaluate, and synthesize necessary information. Students will integrate the practice of critical thinking and reading into the writing process. Class activities include interactive lectures, small group and class discussions, informal debates, mini-conferences, peer feedback, individual presentations, focused listening exercises and focused viewing exercises as well as assorted reading, writing, and grammar assignments. There will be some poetry analysis together with reading and understanding a short story and a drama using stronger and more intensive literary terms and concepts than in 201.

GERL101 Germany I (3CH) (Pre-requisite: -)

Can understand and use familiar, everyday expressions and very simple sentences, which aim at the satisfaction of specific needs. Can introduce oneself, and others, and ask others questions to themselves - e.g. where they live, which people they know or what kind of things they have - and can give answers on questions of this kind. Can communicate on a basic level if those involved with him/ her in a conversation speak slowly and clearly and are willing to help.

GERL102 Germany II (3CH) (Pre-requisite: GERL101)

Can understand sentences and frequently used expressions if those are connected with things of immediate meaning (e.g. information to the person and to the family, buying, work, closer environment). Can communicate in simple, routine situations, with the purpose of a simple and direct exchange of information about familiar and common things. Can describe with simple means their own origin and training, direct environment and things that are in connection with direct needs.

GERL201 Germany III (3CH) (Pre-requisite: GERL102)

Can understand the main points if no dialect is used and if it concerns familiar things about work, school, spare time etc. Can master most situations, which one encounters on journeys in a German speaking area. Can express oneself simply and coherently about familiar topics and areas of personal interest. Can report experiences and events, describe dreams, hopes and goals and give short reasons or explanations about plans and opinions.

GERL202 Germany IV (3CH) (Pre-requisite: GERL201)

Can understand the main contents of complex texts, as well as concrete and abstract topics; even discussions between specialists in his/ her own special field. Can communicate spontaneously and fluidly a normal discussion with native speakers, without larger effort on both sides. Can express oneself clearly and in detail in a broad spectrum of topics, describe a point of view to a current question and indicate the pro and cons of different possibilities.

GERL301 German V (3CH) (Pre-requisite: GERL202)

Can understand and also seize implicit meanings of a broad spectrum of demanding, longer texts. Can express oneself spontaneously and fluidly, recognizing words without having to search for words frequently. Can use the language effectively and flexibly in social and vocational life or in training and study. Can express oneself clearly, structured and detailed, to complex subjects and use appropriate different means for linkage of texts.

GERL302 German VI (3CH) (Pre-requisite: GERL301)

Can understand and assimilate appropriately written and spoken texts, which are relevant in a university-referred context. Can implement appropriately writings and actions of speech, which are relevant in a university-referred context.

BE302: Business Entrepreneurship (3 CH) (Pre-requisite: - English101)

The course focuses on critical skills necessary to develop appropriate financing strategies for new venture creation and growth. Students will use case studies and team projects in course studies. Three primary topics are covered: first, an overview of the entrepreneurial finance process and involved players; second, performing business valuations; and third, securities law with emphasis on developing term sheets and private placement memorandums. Student teams will complete a valuation and mock securities offering for an existing small to mid-size business. Financial valuations and terms sheets developed by student teams will be presented to a panel of venture capital professionals for evaluation and critique.

SE301: Social Entrepreneurship and Enterprises (3 CH) (Pre-requisite: - English101)

This course will serve as an introduction to the field of social entrepreneurship and social enterprises.

Through lectures, field visits, analyses of relevant literature, case studies and exercises, this course will explore social entrepreneurship's potentials, opportunities and limitations. The topics will cover Defining Social Entrepreneurship. Contextualizing Social Entrepreneurship (need, motives, forms, criteria). Role of Leadership, Creativity and Innovation. Locating SE on the profit/non-profit continuum. SE in the larger fields of development, social change, community activism. Social Enterprises (Missions, Markets, Finances). Ethical business and corporate social responsibility.

SFTS101: Soft Skills (3 CH) (Pre-requisite: - English101)

This course is designed to help develop strong oral and written communication skills. The student will be given opportunities to practice writing and editing professional correspondence and technical reports. Additionally, the student will compose and deliver oral presentations. Assignments will include the use of inductive and deductive approaches to conveying a variety of messages. The course emphasis the use of software tools to prepare presentations, stress management, confidence, and sensitivity to others. It also stresses on resume writing and conducting interviews.

DES101: Arts Appreciation (3 CH) (Pre-requisite: - ARB099)

An introductory course designed for non-art students to give them the basic knowledge of arts and simple approaches to the understanding of the history, development, elements, criticism, esthetics and materials of different art forms (visual, aural and performing arts). A comparative approach between the different arts is given to enhance the students' global understanding of arts and to give them the ability to look at art works and form their own opinions. The course is combined with examples of audio and visual arts.

EI101: Leadership and Emotional Intelligence (3 CH) (Pre-requisite: -: ENGL101)

In this course, students will be introduced to the concept of Emotional Intelligence as a means to improve self-management and relationship management. The operative concepts are applied to social, family, academic and professional relationships with an emphasis on leadership implications.

The majority of the curriculum is based upon the book by Daniel Goleman entitled: "Leadership: The Power of Emotional Intelligence," and covers leadership styles and their appropriate applications, the emotional intelligence model, and neurological aspects of the limbic system. The class is a lecture format which encourages student participation.

IC101: Intercultural Communication (3 CH) (Pre-requisite: -: ENGL101)

This course is designed to provide prospective students (whose majors have an international flavor) with tools that offer powerful possibilities for improving the communication process. We will examine the process of sending and receiving messages between people whose cultural background could lead them to interpret verbal and nonverbal signs differently. We will learn about the diversity of these cultural differences and at the same time learn how we might overcome them. Our efforts to recognize and surmount cultural differences will hopefully open up business opportunities throughout the world and maximize the contribution of all the employees in a diverse workforce.

EE3104 Artificial Intelligence in Electrical and Energy Systems (3 CH) (Pre-requisite: -BSC001)

Introduction to AI and machine learning methods for modeling, monitoring, control, optimization, and decision-making in modern electrical and energy engineering applications. The course covers data-driven fundamentals (data preparation, feature engineering, model validation), supervised and unsupervised learning, and selected deep learning approaches, with emphasis on practical engineering workflows, interpretability, and reliability. The course highlights various communication, networking, power and energy applications such as wireless channel/traffic characterization, adaptive resource allocation, signal classification, load and energy generation forecasting and management, condition monitoring and predictive maintenance, and smart grids.

EE3401 Communication Systems and IoT Protocols (3 CH) (Pre-requisite: -BSC001)

This course introduces the fundamental principles of communication systems and modern Internet of Things (IoT) applications. It begins with a review of basic signals and systems, followed by core topics in analog and digital communications, including amplitude and angle modulation, signal spectra, signal-to-noise ratio, sampling, quantization, line coding. The architecture, layers, and design principles of IoT systems, device-to-device communication, network protocols, and cloud integration. Major IoT communication technologies such Wi-Fi, Bluetooth Low Energy, LoRaWAN, 5G/6G IoT, ZigBee, NB-IoT, and industrial protocols, the trade-offs in terms of energy efficiency, coverage, scalability, interoperability, and security. Some practical case studies will be demonstrated as smart cities, healthcare, industrial automation, environmental monitoring, and smart energy systems.

EE4107 Special Topics in Electrical Systems (3 CH) (Pre-requisite: -BSC001)

A course on special topics in Electrical Systems.

EE4204 Power Systems Operation and Control(3 CH) (Pre-requisite: -BSC001)

General characteristics of modern power systems, evolution of power systems, power system control. Equipment characteristics and modeling, control of protective functions, modeling of excitation system. Prime mover and energy supply systems. Control of active and reactive power; modern stability of power systems; linear and nonlinear systems.

EE4216 Special Topics in Power Systems(3 CH) (Pre-requisite: -BSC001)

A course on special topics in Power Systems.

EE4318 Data Analytics for Power and Energy Systems (3 CH) (Pre-requisite: -BSC001)

This course introduces data analytics methods and workflows for power and energy systems. It covers data acquisition and preprocessing (cleaning, missing data, outliers, normalization), exploratory

analysis and visualization, and feature engineering for time-series measurements such as load, voltage/current, power quality, and renewable generation. Topic covers statistical modeling and machine learning techniques used in power and energy applications, with emphasis on model validation, performance metrics, and interpretability.

EE4319 Special Topics Renewable Energy (3 CH) (Pre-requisite: -BSC001)

A course on special topics in Renewable Energy.

IE0121 Probability and Statistics (3CH) (Pre-requisite: MATH101)

Descriptive statistics, probability concepts, discrete and continuous random variables and distributions, joint probability distributions, covariance and correlation of random variables, point and interval estimation for single sample, sampling distributions, and statistical inference for single sample.

IE0141 Engineering Workshop (1CH) (Pre-requisite: -)

General safety, materials and their classifications, measuring devices and their accuracy, theoretical background and practical exercises including, carpentry, welding, mechanical fasteners, drills, lathes, milling machines, and sheet-metal working.

IE0417 Business and Labor Law (3 CH) (Pre-requisite: -BSC001)

A program elective course in business and labor Law.

IE0515 Product Development and Entrepreneurship (3CH) (Pre-requisite: - BSC001)

Integration of the marketing, design, and manufacturing functions of organizations in creating entrepreneurial and new innovative products. Tools and methods for product design and development. Multiple functions in creating a new product (marketing, finance, industrial design, engineering, production), Definition of entrepreneurs and entrepreneurship, Entrepreneurship in economic theory, Historical development of entrepreneurship, Type of entrepreneurship and features and types of businesses and entrepreneurs, Sources of business ideas, Innovation and entrepreneurship, Entrepreneurship and small business

IE0516 Facility and Asset Management (3CH) (Pre-requisite: - BSC001)

Students learn the concepts and methodology of facilities planning as well as layout planning, optimization algorithms applied to facilities layout, selection of material handling systems, and operations of warehouse. Students acquire knowledge and skills in the areas of strategic facilities planning and manufacturing facilities design. Students carry independent project work and research in the field.

IE0533 Supply Chain Engineering (3 CH) (Pre-requisite: BSC001)

The module covers topics related to supply chain design, planning, and integration. This includes sourcing decisions, logistic systems, capacity analyses, aggregate planning, and distribution networks. The module also discusses latest development in supply chain management including sustainability and technology applications. The team project portion of the module allows the students to model and evaluate a real-world supply chain. This includes developing a SIPOC structure, setting KPIs, and optimizing the supply chain network.

IE0562 Industrial Cost analysis (3 CH) (Pre-requisite: -BSC001)

Students gain knowledge regarding managerial accounting and cost concepts, classifications and calculations. Module also introduces ABC and other costing methods such as cost for pricing, cost evaluation and improvement, costs for decision making, budgeting, and variance analysis. Students are introduced to financial balance sheet calculations, depreciation, assets and liabilities, and taxes.

MATH101 Calculus I (3CH) (Pre-requisite: -)

This course introduces the student to the calculus of single-valued functions. Topics include: limits, continuity, rates of change, rules for differentiating, differentials and local linear

approximations, maxima and minima problems, L'Hôpital's rule, related rates, logarithmic and implicit differentiation, inverse trigonometric and hyperbolic functions, Rolle's Theorem, the mean-value theorem, and applications of derivatives and integrals. An overview of integration, basic techniques for integration, algebraic techniques of integration and applications of integrations are also included.

MATH102 Calculus II (3CH) (Pre-requisite: MATH101)

Sequences and series, power series, convergence theorems: integral, ratio, and alternating - series tests, Polar coordinates and functions, integration and differentiation of polar functions, Vectors in three-dimensional space, spherical and cylindrical coordinates, Vector valued functions, Partial derivatives, Multiple integrals, Topics in vector calculus.

MATH203 Applied Mathematics for Engineers (3CH) (Pre-requisite: MATH102)

Vector analysis in Cartesian coordinates; Curvilinear coordinates and transformations to Cartesian, Spherical, and Cylindrical coordinates; line integrals, surface integrals, Green's theorem, Gauss's divergence theorem, and Stokes's theorem. Scalar and vector potential. Review of Series. Linear Algebra; Matrices and linear equations; Matrices and Linear Operators; Determinants, Eigenvalues and eigenvectors.

Complex Numbers and Complex Variable; Representation of complex numbers, DeMoivre's formula, Powers and roots of complex numbers, Functions of complex variable.

MATH205 Differential equations (3CH) (Co-requisite: MATH203)

First-order ordinary differential equations, Second-order ordinary differential equations, System of ODEs. Solution Techniques including Laplace transforms, Fourier series: eigenvalue problems and expansions in orthogonal functions. Partial differential equation: classification, separation of variables, solution by series and transform methods. Models in Applied Mathematics; Applications to illustrate typical problems and methods of applied mathematics in solid and fluid mechanics, fields of physics, dynamics and vibrations, wave phenomena, diffusion phenomena, heat conduction, and biological processes.

ME 0111 Computer Aided Engineering Drawing (2CH) (Pre-requisite: CS 116)

The use of computer aided software in drawing such as AutoCAD. Geometric constructions. Orthographic and Isometric projections; Sketching, sectioning, dimensioning and layering. Model Layout (wire-frame, surface, and solid modeling), plotting to scale, blocks and attributes, Introduction to descriptive geometry, perspective drawing. Engineering applications.

ME 0346 Instrumentations and Measurements (2CH) (Pre-requisite: ENE211, MATH205)

Introduction to instrumentation, Units, Dimensions and standards, Error measurements, Statistical analysis of experimental data, Op-Amp circuits in instrumentation, Basic electrical measurement and sensing devices: physics of electric, magnetic, chemical sensors displacements, area, pressure, flow, temperature, thermal and transport properties, force, torque and strain measurements. Smart sensors and networking of sensor systems. Data acquisition and processing.

ME 0347 Instrumentation and Measurements Lab (1CH) (Co-requisite: ME 0346)

Measurements with different micrometers & Vernier measuring instruments, angular measurements, roundness & concentricity of cylindrical work pieces, tool maker's microscope, optical projectors, surface measurements. Analysis of experimental data and

error estimation. Basic electrical measurement and sensing devices: physics of electric, magnetic, chemical sensors, displacement, area, pressure, flow, temperature, thermal and transport properties, force, torque and strain measurements. Smart sensors and networking of sensor systems. Data acquisition and processing.

MILS 100 Military Sciences (3CH) (Pre-requisite: only for Jordanians)

History of the Jordanian Arab Army. United Nations Peace Keeping Forces. Preparation of the nation for defense and liberation. History of the Hashemite Kingdom of Jordan and its development.

MGT418 Quality Management (3 CH) (Pre-requisite:BSC001)

Total Quality Management (TQM) helps the students to learn to view quality from a variety of functional perspectives, gain a better understanding of the problems associated with improving quality, also quality tools utilized in service and international/environments. This module focuses on the essence, principles, and practices 26 of total quality management (TQM). Some of the ideas and topics that are covered are: process improvement; process orientation; service quality; human resources; customer satisfaction programs; quality function deployment; process control and capability; role of inspection; economics of quality; productivity measurement; learning and organizational performance measures; and teachings of Deming, Juran, and Crosby.

MECH0221 Thermodynamics (3CH) (Pre-requisite: MATH102)

Introduction to thermodynamics concepts, properties of pure substances, first law of thermodynamics: analysis of closed systems, analysis of open systems under steady and unsteady conditions, second law of thermodynamics, entropy.

MECH0222 Fluid Mechanics (3CH) (Pre-requisite: MATH102, PHYS 103)

Physical properties of fluids and fundamental concepts in fluid mechanics, hydrostatics, conservation laws for mass, momentum and energy, flow similarity and dimensional analysis as applied to engineering problems in fluid mechanics, laminar and turbulent flow, engineering applications such as flow measurement flow in pipes and fluid forces on moving bodies.

MECH0552 Management of Maintenance Systems (3 CH) (Pre-requisite:BSC001)

Reliability, availability, maintainability, and safety of industrial structures, systems, and components, maintenance intervention approaches (i.e., corrective, scheduled, condition-based and predictive), maintenance decisionmaking strategies, and techniques for risk assessment and the ways of establishing and running them effectively across multiple industries. The course will also cover the cost estimation and scheduling of maintenance activities and their key performance parameters.

MECH 4214 Thermal Management of Electronic Systems (3 CH) (Pre-requisite:BSC001)

Introduction to principles of thermal management for controlling heat dissipation in electronics systems. Understanding of how basic heat transfer principles can be applied to the thermal design of electronic packages. Passive and active thermal management techniques for electronic systems & components are considered with regard to fundamental heat transfer modes. Design studies for single- and multi-chip modules, printed circuit board, and high-heat-flux cooling.

MECH4407 Failure Analysis (3 CH) (Pre-requisite:BSC001)

Theory of Failure Analysis, Industry Quality Systems Overview, Failure Mode Effect Analysis (FMEA) overview, process flow, control, prevention, detection, and types, and Application of failure analysis in industries.

MECH4410 Six Sigma (3 CH) (Pre-requisite:BSC001)

Introduction to the Define, Measure, Analyze, Improve and Control (DMAIC) method that includes project definition, measurement of the most critical process variables, analysis of the associated data,

improvement based on statistical test planning and control of the future process. Six Sigma concepts and methodologies in practice

MECH5501 Heating Ventilation and Air Conditioning (3CH) (Pre-requisite:BSC001)

Introduction to HVAC economics, HVAC systems, Psychometrics, Indoor air quality/comfort issues, Heat transmission in building structures, Space heating load, Solar radiation, Space cooling load, Fans and duct system design, Pumps and piping design.

MECH5606 Hybrid and Electric Vehicles (3CHr) (Pre-requisite:BSC001)

Hybrid and electric vehicles are currently the dominant technologies in the new generation of automobiles. This course examines the sub-systems of hybrid and electrified vehicles—including the engine—as well as the integration of these sub-systems into the vehicle. The course covers the modeling and analysis of vehicles with electrified propulsion systems, including electric vehicles, hybrids, plug-in, and fuel cell vehicles. The course will introduce students to the concepts and terminology, state-of-the-art developments, energy conversion and storage options, and system integration.

NE 101 National Education (3CH) (Pre-requisite: ARB 099 or ENGL101)

In a context of striving towards democracy like the one Jordan enjoys today, the meaning and practice of active and responsible citizenship becomes more crucial. It is often argued that democracy requires “democrats” to flourish, and become well established. Democrats are those women and men who recognize pluralism, inclusion, positive engagement, and participation as the main values that govern their interaction with the state as citizens and with each other as diverse people of different interests. In this course you will be able to understand your rights and responsibilities as Jordanian citizen, expand your knowledge about the frameworks, and processes that regulates citizen-state relationships as will as the basic necessary skills for you to practice your citizenship rights in a civic manner.

PE101: Sports and Health(3CH) (Pre-requisite: ARB099)

The course focuses on providing students with information related to Sport, fitness and health culture, Voluntary work Nutrition, First Aid. It covers also Special physical preparation and general sports cultural issues

PHYS 103 Physics I (3CH) (Pre-requisite: -)

Physics and measurement, Motion in one dimension, Vectors, Motion in two dimensions, Force and motion, Kinetic energy and work, Potential energy and conservation of energy, Linear momentum and collisions, Rotation, Rolling and angular momentum.

PHYS 104 Physics II (3CH) (Pre-requisite: PHYS 103)

Electric Fields, Gauss’s Law, Electric Potential, Capacitance and Dielectrics, Current and Resistance, Direct Current Circuits, Magnetic Fields, Sources of the Magnetic Field, and Faraday’s Law.

PHYS 106 General Physics Lab (1CH) (Co-requisite: PHYS 104)

Developing a good understanding of a few important concepts in Mechanical physics, learning to apply these concepts to familiar and unfamiliar situations and gaining the ability to reason qualitatively and quantitatively about Mechanics.

TENTATIVE COURSE SCHEDULE

First Semester / First Year				
Course Number	Course Title	CH	Pre-requisite	Co-requisite
ENGL098	English I *	0	-	
GERL101	German I *	3	-	
CS 116	Computing fundamentals	3	-	-
CS 1160	Computing fundamentals lab	1	-	CS116
MATH101	Calculus I	3	-	
PHYS103	Physics I	3	-	
CHEM103	General Chemistry I	3	-	
CHEM106	General Chemistry lab	1	-	CHEM103
MILS100	Military Sciences	3	Only for Jordanian	
Total		20		

Second Semester / First Year				
Course Number	Course Title	CH	Pre-requisite	Co-requisite
ENGL099	English II *	0	ENGL098	
ARB100	Arabic *	3	-	
MATH102	Calculus II	3	MATH101	
GERL102	German II	3	GERL101	
PHYS104	Physics II	3	PHYS103	
PHYS106	General Physics Lab	1	-	PHYS104
ME0111	Computer Aided Engineering Drawing	2	CS116	
IE0141	Engineering Workshop	1	-	
NE101	National Education (in Arabic)	3	ARB 099	
	National Education (in English)		ENGL101	
Total		19		

*Student's score on placement test will decide the course level to start from

First Semester / Second Year				
Course Number	Course Title	CH	Pre-requisite	Co-requisite
ENGL101	English III *	1	ENGL099	
GERL201	German III	3	GERL102	
MECH0221	Thermodynamics	3	MATH102	
ENE211	Electrical Circuits I	3	PHYS104 , MATH102 ARB099 , ENGL099 , MATH099	
MATH203	Applied Mathematics for Engineers	3	MATH102, ARB099, ENGL099, MATH099	
MATH205	Differential equations	3	ARB099, ENGL099, MATH099	MATH203
University Elective	See Elective Table above	3		
Total		19		

Second Semester / Second Year				
Course Number	Course Title	CH	Pre-requisite	Co-requisite
ENGL102	English IV *	1	ENGL101	
GERL202	German IV	3	GERL201	
IE0121	Probability and Statistics	3	MATH101	
ENE212	Electrical Circuits II	3	ENE211	
ENE214	Electronics	3	ENE211, ARB099 ENGL099, MATH099	
ECE333	Electromagnetics	3	MATH203	
ENE301	Introduction to Digital Systems and Microcontrollers	3		ENE214
ENE302	Statistical and Numerical Methods for Energy Engineers	3	MATH205	
Total		22		

First Semester / Third Year				
Course Number	Course Title	CH	Pre-requisite	Co-requisite
ENGL201	English V *	2	ENGL102	
GERL301	German V	3	GERL202	
ENE316	Introduction to Communication Systems for Energy Engineers	3	ENE212	
MECH0222	Fluid Mechanics	3	MATH102, PHYS 103	
ENE213	Electrical Circuits Lab	1	ENE212	
ENE311	Electrical Machines	3	ENE212	ECE333
ENE312	Power Electronics	3	ENE214, ENE212	
ENE323	Fluid Mechanics Lab	1		MECH0222
ENE444	Modeling and Control of Energy Systems	3	MATH205, ENE311	
Total		22		

Second Semester / Third Year				
Course Number	Course Title	CH	Pre-requisite	Co-requisite
ENGL202	English VI *	2	ENGL201	
ENE215	Electronics Lab	1	ENE214, ENE213, ARB099 ENGL099, MATH099	
ENE313	Electrical Machines Lab	1	ENE311	
ENE314	Power Electronics Lab	1	ENE312	
GERL302	German VI	3	GERL301	
ENE321	Heat Transfer	3	MECH0221, MECH0222, MATH205	
ENE324	Introduction to Energy Systems	3	MECH0222	
ENE432	Power Plant Engineering	3	ENE321	
ENE441	Power Systems	3	ENE311, ENE302	
Total		20		

German Year

First Semester / Fourth Year				
Course Number	Course Title	CH	Pre-requisite	Co-requisite
From Specialization Elective Course list	Technical Elective	3		
	Technical Elective	3		
	Technical Elective	3		
	Technical Elective	3		
Total		12		

Second Semester / Fourth Year				
Course Number	Course Title	CH	Pre-requisite	Co-requisite
ENE499	International Internship	12	ENE399	
Total		12		

Renewable Energy Track

First Semester / Fifth Year				
Course Number	Course Title	CH	Pre-requisite	Co-requisite
ME0346	Instrumentations and Measurements	2	ENE211, MATH205	
ME0347	Instrumentation and Measurements Lab	1		ME0346
ENE401	Energy Systems Simulation Lab	1	ENE324 ENE312	ENE444
ENE434	PV Technology I	3	ENE324, ENE212, ENE214	
ENE442	Power Systems Lab	1	ENE441	
ENE443	Electrical Power Generation, Transmission & Distribution	3	ENE441	
ENE537	Energy Efficiency, management and laws	3	ENE324	
ENE433	Solar Energy I	3	ENE324	
ENE598	Graduation Project I	1	ENE499	
Total		18		

Second Semester / Fifth Year				
Course Number	Course Title	CH	Pre-requisite	Co-requisite
ENE435	Wind Energy Technology	3	ENE312, ENE324	
ENE436	Renewable Energy lab	1	ENE324	
ENE532	Energy lab	1	ENE324	
ENE536	Energy Efficiency Lab	1	ENE324	
ENE599	Graduation Project II	3	ENE598	
ENE437	Economics of Natural Resources Engineering	3	MATH203	
Total		12		

Electrical Power Track

First Semester / Fifth Year				
Course Number	Course Title	CH	Pre-requisite	Co-requisite
ME0346	Instrumentations and Measurements	2	ENE211, MATH205	ME0347
ME0347	Instrumentation and Measurements Lab	1		ME0346
ENE401	Energy Systems Simulation Lab	1	ENE324	
ENE434	PV Technology I	3	ENE324, ENE212, ENE214	
ENE442	Power Systems Lab	1	ENE441	
ENE443	Electrical Power Generation, Transmission & Distribution	3	ENE441	
ENE445	Electric Drives	3	ENE312, ENE444	
ENE541	Power System Analysis	3	ENE441	
ENE598	Graduation Project I	1	ENE499	
Total		18		

Second Semester / Fifth Year				
Course Number	Course Title	CH	Pre-requisite	Co-requisite
ENE446	Electric Drives Lab	1		ENE445
ENE543	Power System Protection Lab	1		ENE542
ENE544	Power Systems Integrations Lab	1	ENE301, ENE314, ENE442	
ENE542	Power System Protection	3		ENE541
ENE599	Graduation Project II	3	ENE598	
ENE437	Economics of Natural Resources Engineering	3	MATH203	
Total		12		