الجامعـــة الألمانيـــة الأردنيـــة
German-Jordanian University

GJU
الجامعة الألمانية الأردنية
German Jordanian University

School of Natural Resources Engineering and Management
Department of Energy Engineering

Study plan

Bachelor in Science in Energy engineering

2014 – 2015

Vision

To be a recognized department of energy engineering especially in Renewable Energy education, research outreach programs and high quality graduates.

Mission

To provide students with a sound energy engineering education, especially in Renewable energy and sustainable systems. To serve the economic development, protect the environment, and improve the quality of human life.

Department Objectives

1. To equip students with the technical knowledge necessary to work effectively as energy engineers in an applied environment.
2. To provide students with adequate experience to design systems as individuals and within teams.
3. To qualify engineers who respect the ethics of their profession.
4. To equip students with good communication skills.
5. To prepare students for life-long learning and continuing education.
6. To achieve international reputation in distinct research areas including but not limited to solar and wind energy, energy from waste, etc.

Learning Outcomes

Our graduates should be able to demonstrate the ability to

A. Apply knowledge of mathematics, science, and engineering in practice.
B. Design and conduct experiments as well as analyze and interpret data.
C. Design systems, components, or processes to meet the desired needs.
D. Function within multidisciplinary teams.
E. Identify, formulate, and solve engineering problems.
F. Understand professional and ethical responsibilities of energy engineers.
G. Communicate effectively.
H. Obtain broad knowledge to understand the implications of engineering solutions within global and societal contexts.
I. Recognition of the need for, and possess the ability to engage in, lifelong learning.
J. Possess knowledge of contemporary issues.
K. Use the techniques, skills, and modern engineering tools necessary for engineering practice.
L. Adhere to safety rules and regulations.

Course Coding (Numbering)

A four letters (or three letters, if necessary) and three 3-numbers code is given to each course offered by the department as shown below:

Department			Level/Year	Field	Sequence
A	B	C	X	Y	Z

The Department codes (A, B, C) are selected as follows:

Code	Department
ENE	Energy Engineering

Therefore, courses in Energy Engineering (ENE) will have numbers of the form E**NE** XYZ, where the coding of X, Y and Z is described as follows:

A- The middle digit (Y) denotes the course subject area as follows:

Number	Field
0	General/Miscellaneous
1	General Mechanics (Dynamics & Strength of Materials, Vibration)
2	Thermodynamics, Fluid Mechanics, Heat Transfer, Control and electronics
3	Power generation, distribution and Transformation.
4	Renewable Energy
5	Energy conversion and managements, Energy Laws
6	Engineering Statistics, Economics
7	Simulation, labs, workshops
8	Projects, Special Topics & Training

B- The leftmost digit (X) denotes the level of the course according to student's study plan as follows:

Number	Level of Course
1	First year
2	Second year
3	Third year
4	Fourth year
5	Fifth year.

C- The rightmost digit (Z) denotes the course sequence in its subject area (Odd numbers represent first semester and even numbers represent second semester courses.

ENE 511			
ENE	5	1	1
Energy Engineering department	5th year level	General Mechanics field	1st semester sequence / offering

Undergraduate Curriculum

Program of Energy Engineering

Framework for B.Sc. Degree (Semester Credits)

Classification	Credit Hours		
	Compulsory	Elective	Total
University Requirements	24	6	30
School Requirements	40		40
Program Requirements:	98	12	110
Total =	162	18	180

1. University Requirements (30 Cr. hrs)

1.1 University Compulsory Requirements (24 Cr. hrs)

Course No.	Course Title	Cr. hrs	Lec.	Lab Contact hrs.	Prerequisite
ARB100	Arabic	3	3	0	-
ENGL98	English I	0	3	0	-
ENGL99	English II	0	3	0	ENGL98
ENGL101	English III	1	3	0	ENGL99
ENGL102	English IV	1	3	0	ENGL101
ENGL201	English V	2	3	0	ENGL102
ENGL202	English VI	2	3	0	ENGL201
GER101	German I	3	0	3	-
GER102	German II	3	0	3	GER101
GER201	German III	3	0	3	GER102
NE101	National Education	3	3	0	-
MILS 100	Military Sciences	3	3	0	-

1.2 University Requirements (6 Cr. hrs)

University Elective Requirements (Humanities + Social & Economic Sciences)							
Course No.	Course Title	Cr. hrs	Lec.	Lab Contact hrs.			Prerequisite
DES101	Arts' Appreciation			3	3	0	
IC101	Intercultural Communications			3	3	0	
SFTS101	Soft Skills			3	3	0	
SE 301	Social Entrepreneurship & Enterprises			3	3	0	

2. School Compulsory Requirements (40 Cr. hrs.)

Course No.	Course Title	Cr. hrs	Lec.	Lab Contact hrs.	Prerequisite
MATH101	Calculus I	3	3	0	Math 099 or Place. test
MATH102	Calculus II	3	3	0	MATH 101
MATH203	Applied Mathematics for Engineers	3	3	0	MATH102
MATH205	Differential Equations	3	3	0	MATH102
MATH 231	Probability & Statistics for Engineers	3	3	0	MATH 102
PHYS103	Physics I	3	3	0	--
PHYS104	Physics II	3	3	0	PHYS103
PHYS106	General Physics Lab	1	0	3	Co-Req. PHYS104
GER202	German IV	3	0	6	GER201
GER301	German V	3	0	9	GER202
ME111	Computer Aided Engineering Drawing	3	3	3	CS116
CHEM103	General Chemistry	3	3	0	--
CHEM106	General Chemistry Lab	1	0	3	Co-Req. CHEM103
CS116	Computing fundamentals	3	3	0	-
CS1160	Computing fundamentals lab	1	0	3	Co-Req. CS116
IE121	Engineering Workshop	1	0	3	ME111

3. Department Compulsory Requirements (98 Cr. hrs)

3.1 - All tracks (81)

Course No.	Course Title	Cr. hrs	Lec.	Lab Contact hrs.	Prerequisite
ENE211	Electrical circuits I	3	3	0	PHYS104
ENE212	Electrical Circuits II	3	3	0	ENE211
ENE213	Electronics	3	3	0	ENE211
ENE214	Electrical circuits Lab	1	0	3	ENE211
TME212	Statics	3	3	0	PHYS103, MATH102
TME213	Mechanics of Materials	3	3	0	TME212, TME214
TME214	Dynamics and Vibrations	3	3	0	TME212
TME221	Thermodynamics	3	3	-	MATH102, CHEM103
TME222	Fluid Mechanics	3	3	0	MATH205, PYS 104
GER302a	German VI *	3	2	3	GER301, TME 222
ENE311	Electrical Machines	3	3	0	ENE212
ENE312	Power Electronics	3	3	0	ENE213
ENE313	Electrical Machines Lab	1	-	3	ENE311
ENE314	Power Electronics Lab	1	0	3	ENE312
ENE321	Heat Transfer	3	3	0	TME222, TME221
ENE322	Thermal Science Lab	1	0	3	TME222, TME221
ENE323	Fluid Mechanics Lab	1	0	3	TME222
IE333	Numerical Analysis for Engineers	3	2	3	CS116, MATH203, MATH205
ME344	Control Systems I	3	3	0	ENE211, MATH205
ME346	Instrumentations and Measurements	2	2	3	ENE211, MATH205
ME347	Instrumentation and Measurements Lab	1	0	3	Co-requisite: ME346
ENE399	Field Training**	0			-
ENE431	Energy Conversion	3	3		TME222, ENE321
ENE432	Power Plants Engineering	3	3	0	TME222, ENE321
ENE499	International Internship	12	0	36	ENE399
ENE515	Electrical Power Generation, Transmission & Distribution	3	3	0	ENE311
TME515	Mechanical Vibrations	3	3	-	TME214, MATH205
ENE536	Energy Engineering Economics	3	3	0	ENE431
ENE598	Graduation Project I	1	0	3	-
ENE599	Graduation Project II	3	0	9	ENE598

*** Only for Energy Engineering Students: GER302 includes the technical course: 'Fundamentals of Renewable Energy systems (auf deutsch)'**

**** Field training for a period of 160 hours and two consecutive weeks in a qualified company**

3.2- Compulsory Renewable Energy Track (17 Cr. hrs)

Course No.	Course Title	Cr. hrs	Lec.	Lab Contact hrs.	Prerequisite
ENE433	Solar Energy I	3	3	0	ENE431
ENE434	PV Technology	3	3	0	ENE431
ENE435	Wind Energy Technology	3	3	0	ENE431
ENE436	Renewable Energy lab	1	0	3	ENE431, ENE312, ENE311
ENE532	Energy lab	1	0	3	ENE431
ENE537	Energy Efficiency, management and laws	3	3	0	ENE431
ENE571	Modeling and simulation techniques of energy systems	3	2	3	CS116, MATH205, IE333

3.3- Compulsory Electrical Power Track (17 Cr. hrs)

Course No.	Course Title	Cr. hrs	Lec.	Lab Contact hrs.	Prerequisite
CME343	Digital electronics	4	3	3	CME 241 or ENE213
ENE411	Electric Drives	2	2	0	ENE311
ENE415	Power Systems	3	3	0	ENE311, ENE212, IE333
ENE416	Communication Systems and Networking.	3	3	0	CS116
ENE516	Smart-Grid Power Systems	3	3	0	ENE312
ENE541	Real Time Computer Control Systems	3	3	0	ME344

4. Elective Courses (12 Cr. hrs)

4.1 Renewable Energy Track (Up to 12 Cr. hrs from the following table).

Course No.	Course Title	Cr. hrs	Lec.	Lab Contact hrs.	Prerequisite
TME522	Heating Ventilating and Air Conditioning (HVAC)	3	3	0	ENE321
ENE524	Geothermal and Hydropower systems	3	3	0	ENE431
ENE525	Fuel Cell & Hydrogen Production Technology	3	3	0	ENE431
ENE526	Bio-Energy Technology	3	3	0	ENE431
ENE527	Techno-economics of energy systems	3	3	0	ENE431
ENE528	Energy Storage	3	3	0	
TME529	Turbomachinery	3	3	0	TME 222
ENE531	Environmental and Energy Engineering	3	3	0	CHEM103
ENE533	Solar Energy II	3	3	0	ENE433
ENE534	Low Carbon Buildings	3	3	0	
ENE544	Thermal and Hydrodynamic equipment	3			ENE 321
ENE462	Applied Refrigeration	3	3	0	ENE321
ENE595-A	Special Topics	1	1	0	
ENE595-B	Special Topics	2	2	0	
ENE595-C	Special Topics	3	3	0	

4.2 Electrical power Track <u>(Up to 12 Cr. hrs from the following table).</u>

Elective Courses Electrical Power Track (12 credit hours)					
Course No.	Course Title	Cr. hrs	Lec.	Lab Contact hrs.	Prerequisite
CME331	Electromagnetic I	3	3	0	ENE211
ENE511	Special Electrical Machines	3	3	0	ENE311
ENE513	Power Systems Operation and Control	3	3	0	ENE415
ENE517	Power Systems Protection	3	3	0	ENE415
ENE518	High Voltage Engineering	3	3	0	ENE415
ME554	Programmable Logic Controllers	3	2	3	ME344
ENE595-A	Special Topics	1	1	0	
ENE595-B	Special Topics	2	2	0	
ENE595-C	Special Topics	3	3	0	

4.3 For each track, up to 6 Cr. hrs can be chosen from the other track as an elective.

Courses Description

ARB 100: Arabic	***(3 Cr. Hrs.)***
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.	

ENGL 098: English I (Elementary English)	***(0 Cr. Hrs.)***
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 (PreIntermediate English)	***(0 Cr. Hrs.)***
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.	

ENGL 101: English III (Intermediate English)	***(1 Cr. Hr.)***
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.	

ENGL 102: English IV (Upper Intermediate English)	***(1 Cr. Hr.)***
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.	

ENGL 201: English V (Advanced English I)	***(2 Cr. Hrs.)***
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.	

ENGL 202: English VI (Advanced English II)	***(2 Cr. Hrs.)***
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.	

GER 101: German I	***(3 Cr. Hrs.)***
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.	

GER 102: German II	***(3 Cr. Hrs.)***
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.	

GER 201: German III	***(3 Cr. Hrs.)***
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.	

NE 101: National Education	**(3 Cr. Cr. hrs)**
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.	

MILS 100: Military Sciences	***(3 Cr. Cr. hrs)***
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.	

IC 101: Intercultural Communication	***(3 Cr. Cr. hrs)***
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.	

SFTS 101: SOFT SKILLS	***(3 Cr. Cr. hrs)***
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.	

SE 301: Social Entrepreneurship and Enterprises	***(3 Cr. hrs)***
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.	

MATH101: Calculus I	**(3 *Cr. Hrs*)**
Review of functions: notation, operations,Limits and continuity, including trigonometric functions, Derivatives: rates of change and techniques of differentiation, including trig functions, Function composition, chain rule, and implicit differentiation, Applications of derivatives: related rates and optimization problems, Exponential and logarithmic functions — graphs, derivatives, and applications, Inverse trigonometric and hyperbolic functions — graphs, derivatives, and applications, L'Hôpital's rule, improper integrals, Techniques of integration — integration by parts, integration by partial fractions. **Prerequisites: MATH 099 (or Pass replacements test)**	

MATH102: Calculus II	**(3 *Cr. Hrs*)**
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. **Prerequisites: MATH101**	

MATH203: Applied Mathematics for Engineers	**(3 *Cr. Hrs*)**
Infinite Series; Infinite series of constant terms, Convergence tests, Power series and radius of convergence, Taylor and Laurent series. Linear Algebra; Vector analysis in Cartesian coordinates; Curvilinear coordinates and transformations to Cartesian, Spherical, and Cylindrical coordinates; 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. **Prerequisites: MATH102**	

MATH205: Differential Equations	**(3 *Cr. Hrs*)**
Ordinary differential equations' Sturm-Liouville theory, properties of Special Functions, Solution methods 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, deformation and vibration, wave phenomena, diffusion phenomena, heat conduction, chemical and nuclear reactors, and biological processes. **Prerequisites: MATH102**	

MATH231: Probability and Statistics for Engineers	**(3 *Cr. Hrs*)**
Probability, Discrete Distributions and their applications, Continuous Distributions and their applications, Estimation of parameters, Hypothesis testing, Regression, Quality control for engineers. **Prerequisites: MATH102**	

PHYS103: Physics I	**(3 *Cr. Hrs*)**
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. **Prerequisites: None**	

PHYS104: Physics II	**(3 *Cr. Hrs*)**
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**.** **Prerequisites: PHYS103**	

PHYS106: General Physics Lab	**(3 *Cr. Hrs*)**
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**.** **Pre/Co-requisites: PHYS104**	

GER 202: German IV	***(3 Cr. Hrs.)***
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.	

GER 301: German V	***(3 Cr. Hrs.)***
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.	

ME 111 Computer Aided Engineering Drawing	(**3 *Cr. Hrs***)
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**.** **Prerequisites: CS116**	

CHEM103. General Chemistry	**(3*Cr. Hrs*)**
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. **Prerequisites: None**	

CS1160: General Chemistry lab	**(1 *Cr. Hrs*)**
Performing Chemical Experiments based on the general chemistry course. **Pre/Co-requisites:CHEM103**	

CS116: Computing Fundamentals	(**3 *Cr. Hrs***)
Basic computer skill; Programming concepts; algorithms: data types, arithmetic, logical, relational, Boolean, and assignment operators, simple input and output statements; programming control structures; data structures: single and multidimensional arrays; character strings; functions; pointers; file structures and representation; 3-hours lab session every week to enhance hands-on experience on topics that are theoretically covered in the course. **Prerequisites: None**	

CS1160: Computing fundamentals lab	**(1 *Cr. Hrs*)**
Performing Experiments based on the computing fundamental course. **Co-requisites: CS116**	

IE121 Engineering Workshop	**(1 *Cr. Hrs*)**
General safety, materials and their classifications, measuring devices and their accuracy, basic household plumbing and electricity, fits and tolerances, theoretical background for the practical exercises including fitting, forging, carpentry, casting, welding, mechanical saws, shearers, drills, lathes, milling machines, shapers and grinders. **Pre/Co-requisites: ME111**	

ENE211: Electrical Circuits I	**(3 *Cr. Hrs*)**
Overview: 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. **Prerequisite: PHYS104**	

ENE212: Electrical Circuits II (3 *Cr. Hrs*)
Calculating average and reactive power, power in parallel loads, maximum power transfer. Analysis of 3-phase circuits: calculating wattmeter readings in 3-phase circuits. Introduction to Laplace Transform: poles and zeros, initial- and final value theorems. The Laplace Transform in circuit analysis. Active filter circuits. Fourier series. The Fourier Transform. Two-port circuits. **Prerequisite: ENE211**

ENE213: Electronics	**(3 *Cr. Hrs*)**
Introduction to (semiconductor) electronic devices. Semiconductor p-n junction, the transistor. Analysis and synthesis of linear and nonlinear electronic circuits containing diodes and transistors. Elementary analog circuit analysis. Fundamentals of transistors and voltage amplification. Characterization of MOS transistors for circuit simulation. Common-source amplifiers, MOSFET source-follower buffer stage, differential amplifier stage, and MOSFET current sources. Operational amplifiers. Development of a Basic CMOS Operational amplifier. **Prerequisite: ENE211**	

ENE214: Electrical Circuits Lab	**(1 *Cr. Hrs*)**
Resistive circuits, Potentiometers, Superposition, Thevenin's theorem and maximum power transfer, RLC current and voltage characteristics, Frequency response of RL, RC and RLC circuits, Series and parallel resonant circuits, Amplifiers. **Prerequisite: ENE211**	

TME212: Statics	**(3 *Cr. Hrs*)**
Vector mechanics of forces and moments, free-body diagrams, couples, resultants, equilibrium of particles and rigid bodies in two and three dimensions, forces in trusses, frames, and machines, centroids, centers of mass, distributed forces, internal shear forces and bending moments in beams, shear force and bending moment diagrams, friction, area of moments of inertia. **Prerequisites: MATH102, PHYS103**	

TME213: Mechanics of Materials	**(3 *Cr. Hrs*)**
Normal and shear stress and strain, deflection of axially loaded members, thermal stress, torsion of bars with circular sections, shear stress, angle of twist, power transmission, bending of beams, bending and shear stress, combined loadings, beam deflection, column buckling. **Prerequisites: TME212, TME214**	

TME 214: Dynamics and Vibrations	**(3 *Cr. Hrs*)**
Kinematics and kinematics of particles, Newton's laws, planar kinematics and kinetics of a rigid bodies, free vibration of single degree of freedom systems, harmonic excitation, general force response. **Prerequisites: TME212**	

TME221: Thermodynamics (3 *Cr. Hrs*)
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. **Prerequisites: MATH102, CHEM103**

TME222: Fluid Mechanics (3 *Cr. Hrs*)
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. **Prerequisites: MATH205**

GER 302: German VI: Fundamentals of Renewable Energy Systems	***(3 Cr. Hrs.)***
This course is divided into two sub-courses: technical course to be taught at the Energy Engineering Department and a German course at the German Language Centre.The technical course will be taught in German. It lays the foundation for the use of renewable energy sources and provides an overview of the potential of the environmentally friendly use of regenerative energy sources. In particular, application-specific knowledge about solar radiation is provided. Furthermore, the primary components for the conversion of natural energy in form of solar radiation into useful forms of energy, such as heat, and electrical energy are discussed. The content comprises the natural energy forms, the systematization of energy conversion principles, solar radiation, solar energy, solar thermal and photovoltaic systems as well as the importance of wind and waterpower. The participants acquire the skills and the basics to construct renewable energy systems in the German language**.** The linguistic part of this course is designed to enable students to understand and assimilate appropriately written and spoken texts, which are relevant in a university-referred context. The student will be taught to implement appropriately writings and actions of speech, which are relevant in a university-referred context. **Prerequisite: GER301, TME 222**	

ENE311: Electric Machines	**(3 *Cr. Hrs*)**
Magnetic circuit. Transformers: construction and performance characteristics, three-phase connection, autotransformer. DC machines: construction, performance equations, characteristics, starting and speed control of motors. Three-phase induction motor: construction, operation, performance calculations, starting and speed control. Synchronous machines: construction, generator and motor operation and characteristics. Single-phase induction motors. Universal motors. **Prerequisite: ENE212**	

ENE312: Power Electronics	**(3 *Cr. Hrs*)**
Power semiconductor devices: types, drive circuits, protection circuits and power loss calculations. AC-DC converters: uncontrolled, half-controlled and fully controlled single-phase and three-phase rectifiers. AC-AC converters: cycloconverters. DC-AC inverters: single-phase and three-phase. DC-DC converters' topologies analysis and design: step-down, step-up, and step-down/up converters. **Prerequisite: ENE213**	

ENE313: Electric Machines Lab	**(1 *Cr. Hrs*)**
Transformers: characteristics, single-phase and three-phase. DC motors: speed and torque characteristics. Three-phase and single phase induction motors. Synchronous motors and generators. Universal motors. **Prerequisite: ENE311**	

ENE314 : Power Electronics Lab	**(1 *Cr. Hrs*)**
Single-phase fully-controlled bridge rectifier with static and rotating loads. Single-phase half-controlled bridge rectifier. Three-phase controlled bridge rectifier. Single-phase ac voltage controller. Frequency converter. Single-phase bridge inverter with static and rotating loads. Three-phase bridge inverter. Step-down and step-up converter. **Prerequisite: ENE312**	

ENE321: Heat Transfer	**(3 *Cr. Hrs*)**
Introductory course for Conduction, Convection and Radiation. In conduction, the course covers: steady state (1D and 2-D), Transient state. In convection, the course covers: Forced (external and internal), natural convection and heat exchangers. In radiation, the course covers: black body radiation, radiative properties, shape factors and gray surfaces radiation. **Prerequisite: TME222, TME221**	

ENE322: Thermal Science Lab	**(1 *Cr. Hrs*)**
Experiments on thermo-fluid systems including: pipe flows, flow meters, hydrostatic forces, pump performance, jet forces, thermal conductivity, heat transfer coefficients, heat exchanger performance, air-conditioning processes, refrigeration cycles, boiling and condensation, and steam devices. **Prerequisite: TME 222, ENE321**	

ENE323: fluid mechanics Lab	**(1 *Cr. Hrs*)**
Measurement of thermal conductivity, forced convection heat transfer, measurement of specific heat ratio, flow through nozzles, losses in pipes and fittings, hydrostatic pressure, impact of water jet, flow visualizations, performance of hydraulic positive displacement pumps. **Prerequisites: TME222**	

IE333: Numerical Analysis for Engineers	**(3*Cr. Hrs*)**
Introduction into numerical analysis. Introduction and practice in programming of Matlab and Simulink. Representation of data and numerical errors. Numerical Methods for the solution of systems of linear algebraic and differential equations. Matrices and their properties. Classification of systems of linear algebraic equations. Matrix factorization. Gauss elimination algorithm. Cholesky algorithm. Iterative methods (Jacobi, Gauss-Seidel) and their convergence. Eigenvalues and eigenvectors. Euler and Runge-Kutta methods and their properties for solving ordinary differential equations.	
Prerequisites: CS116, MATH203, MATH205	

ME344: Control Systems	**(3 *Cr. Hrs*)**
Modeling of dynamic systems, linearization of nonlinear systems, transient response, transfer function, block diagrams, steady state error and stability, root locus, PID control, lead, lag, and lead- lag control, Bode plots, and Nyquist stability criterion. **Prerequisite: MATH205, TME214, ENE211**	

ME346: Instrumentation and Measurements	**(2 *Cr. Hrs*)**
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. **Prerequisite: ENE211, MATH205**	

ME347 Instrumentation and Measurements Lab	**(1 *Cr. Hrs*)**
Measurements with different micrometers & vernier measuring instruments, angular measurements, toolmaker'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. **(Co-requisite: ME346)**	

ENE431: Energy Conversion	**(3 *Cr. Hrs*)**
This course covers three aspects of energy: Energy resources, Energy Conversion, Development, and environment. Energy Sources: Fossil fuels including, petroleum, coal, oil shale and tar sand, natural gas and hydrogen power. Renewable energy sources including: solar, wind, biomass, hydroelectric and geothermal. Energy Conversion: Conversion of thermal energy into electrical power including thermoelectric converters and fuel cells, thermoelectric systems, electric generators and alternators. Development and environment: implications for sustainable development: Technical, economic, ethical and philosophical aspects of sustainable development, Environment and sustainable development at urban, national and international levels. **Prerequisite: TME 222, ENE321**	

ENE432: Power Plants Engineering	**(3 *Cr. Hrs*)**
This course will be divided in two parts: Power cycle review, thermal power plant and power market. Power cycle review covers: Vapor-cycles, gas turbine-cycles, and combined-cycles. Thermal power plant covers: components, selection and economics for Steam and gas turbine power plants which include: steam generators, condenser and condensate, feed-water heating systems which covers Fuel management and boiler automatic control systems, turbine plant, generator plant, turbine and generator control and protection systems, cooling water systems, steam and water cycle, power plant thermal performance and efficiency losses. power market covers: Alternative power generation technologies, electricity and gas networks and markets, climate change and energy markets. **Prerequisite: ENE431**	

ENE515: Electrical Power Generation, Transmission & Distribution (3 *Cr. Hrs*)
Power generation, transformers, transmission and distribution line structures and equipment; transmission system planning; parameters and equivalent circuits in symmetrical components for overhead and underground lines; DC-Transmission lines; construction of substations, transmission and distribution power lines, sag and tension Analysis. **Prerequisite: ENE311**

TME515: Mechanical Vibrations (3 *Cr. Hrs*)
Fundamentals of vibration, free and force vibration of (undamped/damped) single degree of freedom systems. Vibration under general forcing conditions. Free and force vibration of (undamped/damped) two degree of freedom systems. Free and force vibration of (undamped/damped) multi-degree of freedom systems. Determination of natural frequencies and mode shapes. **Prerequisites: TME214, MATH205**

ENE536: Energy Engineering Economics (3 *Cr. Hrs*)
The course covers the basics of economics and investment decisions. Topics such as time value of money, depreciation models, capital recovery and tax implications, rate of return, cash-flow development, project evaluation methods, risk analysis and break-even concepts are covered. Micro-economic topics such as demand and supply elasticity, utility functions, types of markets, and game models are also covered. Furthermore, the course shall discuss energy related environmental and regulatory issues. **Prerequisite: ENE431**

ENE433: Solar Energy I (3 *Cr. Hrs*)
The course comprises principles and technologies of solar thermal energy. Students will acquire an overview of solar radiation, calculation of incident power on stationary and sun-tracking solar thermal collectors, and an overview of solar thermal technologies. The course will comprehend modeling the performance and the efficiency of solar thermal collectors including a synopsis of quality test methods of solar thermal collectors. Knowledge on design and sizing of solar thermal systems, especially solar water heating systems, will be obtained by students attending the course. Finally, the course will describe relevant engineering applications of solar thermal technologies such as solar space heating and cooling. **Prerequisite: ENE431**

ENE434: PV Technology	**(3 *Cr. Hrs*)**
The characteristics of sunlight. Semiconductor and P-N junctions. The behavior of solar cells. Cell properties and design. PV cell interconnection and module fabrication. Stand-alone photovoltaic system components. Designing stand-alone photovoltaic systems. Specific purpose photovoltaic applications. Remote area supply systems. Grid-connected photovoltaic systems. Photovoltaic water pumping system components. PV water pumping system design. **Prerequisite: ENE431**	

ENE435: Wind Energy Technology	**(3 *Cr. Hrs*)**
Basic characteristics of wind. Site characterization. Statistical methods of wind analysis. wind resources assessment. Fundamental principles of wind turbines; horizontal axis (HAWT) and vertical axis (VAWT). Aerodynamics, mechanical and electrical design aspects of HAWT and VAWT. Performance analysis of wind turbines. Wind machine technologies. **Prerequisite: ENE431**	

ENE436: Renewable Energy Lab	**(3 *Cr. Hrs*)**
Hands-on laboratory experiments in the area of sustainable energy. The fundamental principles required will be provided prior to laboratory experimentation. Topics covered include but are not limited to, solar-thermal energy and photovoltaics, energy storage in batteries and ultra-capacitors, wind energy, ethanol production from corn and sugar and bio-diesel extraction from algae. **Prerequisite: ENE431, ENE312, ENE311**	

ENE532: Energy lab	**(1 *Cr. Hrs*)**
Experiments on energy production including: Gas Turbine Power System, Steam Turbine Lab, Ram Jet Engine, Internal Combustion Engine, Combustion Laboratory, Sterling Engine. **Prerequisite: ENE431**	

ENE537: Energy Efficiency, Management and Law	**(3 *Cr. Hrs*)**
Energy management principles; energy conservation; energy auditing; analysis; formulation of energy management options; economic evaluation, implementation & control; energy conservation techniques – conservation in energy intensive industries; integrated resource planning; demand-side management; cogeneration; total energy schemes; thermal insulation; energy storage; economic evaluation of conservation technologies; analysis of typical applications. Energy law and regulation in Jordan and worldwide. **Prerequisite: ENE431**	

ENE571: Modeling and Simulation of Energy Systems.	**(3*Cr. Hrs*)**
Basic principles underlying piping, pumping and heat exchangers. 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. Design tools such as such as TRANSYS, EES, MathCad (Mathematics) are used in this course. **Prerequisite: CS116, MATH205, IE333**	

CME343: Digital Electronics	**(3 *Cr. Hrs*)**
Digital electronic topics include determining the logic voltage levels, speed and power of Bipolar Junction Transistor, BJT and Field Effect Transistor, FET logic circuits and latching circuits. Also covered will be analysis of BJT and FET ROM and RAM cells. Analog topics include input resistance, output resistance, voltage, and current gain of single transistor amplifiers. Cascading and coupling of multiple transistors producing differential circuits, constant current sources and high gain amplifiers will also be discussed. The course will conclude with a discussion of feedback and stability of feedback amplifiers. **Prerequisite: ENE213 or CME241**	

ENE411: Electric Drives	**(2 *Cr. Hrs*)**
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 drive. **Prerequisite: ENE311**	

ENE415: Power Systems	**(3 *Cr. Hrs*)**
Over all introduction of power systems, transformers, load flow of power systems, series impedance of transmission lines capacitance of transmission lines; current and voltage relations on a transmission line; the impedance and admittance models and network calculations. Gauss Siedel and Newton Raphson methods to solve nonlinear algebraic power flow equations, symmetrical and unsymmetrical fault analysis. **Prerequisite: ENE311, ENE212, IE333**	

ENE416: Communications Systems and Networking (3 *Cr. Hrs*)

The goal will be to study approaches that will enable secure, real-time, two-way communications across the numerous entities within the grid so that it can 1) heal itself; 2) operate efficiently; and 3) engage customers in its improved operation. Course discussion will focus on several types of networks: home networks, smart meters and Automated Meter Reading Infrastructure (AMRI), wireless mesh networks, sensor networks, metropolitan and wide area networks. The course will also cover related topics in the design and implementation of the Supervisory Control and Data Acquisition (SCADA) system and the IntelliGrid architecture, an open-standards and requirements-based approach for integrating data networks and equipment in smart grids. The course will address relevant overlaps with telecommunications technologies (e.g., Ethernet, G.hn, WiMAX, Wi-Fi, Zigbee, TCP/IP, etc.) and how these approaches may be used to enhance grid functionality and response.

Prerequisite: CS116

ENE516: Smart-Grid Power Systems (3 *Cr. Hrs*)

This course presents a new concept in power systems, by integrating three areas of electrical engineering, (Power systems, Power electronics, and electric energy conversion systems). It addresses the fundamental design of renewable energy, such as wind and solar energies, and the integration to electrical power grid via smart switching elements (DC-DC converter, DC-AC inverter, and AC-DC rectifier). In addition, the concept of involving intelligent control SCADA system in smart power grid will be presented.

Prerequisite: ENE312

ENE541: Real Time Computer Control Systems (3 *Cr. Hrs*)

Introduction to digital control. Discrete system analysis. Difference equations. Discrete transfer functions, z-transform, discrete signal analysis. Controllers implemented in real-Time system; PID control in discrete systems. Implementation of Direct Digital Control algorithms. Examples from industry. Implementation of the basic PID algorithm in real -time, Synchronization of the control loop, Timing Considerations in implementation of Control Loops. Hard and soft real-time systems, Real-time scheduling theory. Interfacing processes to real time computer (ADC and DAC), program controllers in real–time high-level language Examples and Applications from Industry.

Prerequisite: ME344

TME522: Heating Ventilating and Air Conditioning (HVAC) (3 *Cr. Hrs*)

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.

Prerequisites: ENE321

ENE524: Geothermal and Hydropower Systems (3 *Cr. Hrs*)
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 pico, 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. **Prerequisite: ENE431**

ENE 525: Fuel Cells and Hydrogen Production (3*Cr. Hrs*)
Overview of the various types of fuel cells followed by a detailed discussion of the proton-exchange membrane (PEM) fuel cell fundamentals: thermodynamic relations, kinetics, and overall design and performance characteristics of PEM fuel cells. Hydrogen production technology, hydrogen systems modeling, hydrogen applications, life-Cycle analysis methods, hydrogen production from hydrocarbons, hydrogen delivery and storage systems and safety. **Prerequisites: ENE431**

ENE526: Bio-Energy Technology (3 *Cr. Hrs*)
Chemistry & Biochemistry of biomass, Biodiesel, Bio-Methane, Bio-Ethanol & Bio-Hydrogen, Bio-Energy Systems, Direct Biomass Combustion & Co-firing Technologies, Gasification & pyrolysis Technologies, Analysis and evaluation of the Biotechnologies and policies and future of Bio-fuels and Bio-Energy. **Prerequisite: ENE431**

ENE527: Techno-economics of Energy Systems (3 *Cr. Hrs*)
This course will provide students with sufficient knowledge on technical and economic features of renewable energy systems. Furthermore, the feasibility of renewable energy systems will be introduced in depth. The economic competitiveness of renewable energy systems compared to conventional systems will be highlighted in the course mainly for utility scale electric generation systems. Moreover, students are required in this course to conduct term work to enhance their learning by using practical methods to define the systems' technological and economic feasibilities. **Prerequisites: ENE431**

ENE528: Energy Storage **(3 *Cr. Hrs*)**

Thermal and electric storage is crucial for the implementation of renewable energy technologies because of the fluctuating nature of the renewable energy resources. Energy storage allows better management for energy use from renewable energy systems, in which the available energy will be used only when required. The energy storage course will introduce renewable energy engineering students to the different energy storing technologies with emphasis on electrical and thermal energies storage. Furthermore, energy storage strategies for system optimization will be covered in this course.

Prerequisites: None

TME529: Turbomachinery **(3 *Cr. Hrs*)**

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.

Prerequisites: TME221

ENE531: Environmental and Energy Engineering **(3 *Cr. Hrs*)**

Application of scientific and engineering principles to an understanding of 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. Introduction to the physical, chemical, and biological systems relating to the quality of water, land and air environments. Topics relating energy to environmental engineering will be addressed, these topics include carbon production, heat and energy transfer and thermal pollution.

Prerequisite: CHEM103

ENE533: Solar Energy II **(3 *Cr. Hrs*)**

The course will cover an introduction to solar radiation; solar incident power on sun-tracking collectors; Review of the basics of thermodynamics and heat transfer, Power plant Technologies; Types of CSP systems including CSP parabolic trough systems, CSP dish technology, CSP Fresnel technology and Solar tower; Heat storage systems; Hybridization; Secondary use of CSP systems; Operation and maintenance of CSP systems; Power quality control and grid integration; CSP plant project planning: economic, social and environmental considerations and site assessment.

Prerequisite: ENE433

ENE534: Low Carbon Buildings **(3 *Cr. Hrs*)**

The fundamentals of conventional energy sources used in buildings; renewable technology; policies and drivers that are leading to the more widespread uptake of low carbon building technologies; low carbon building codes, global policies and planning from the past, present and future. Integrated design: urban microclimate design, passive architectural interventions, active interventions. Low carbon buildings design and operation.

Prerequisites: None

ENE544.Thermal and Hydrodynamic equipment	**(3*Cr. Hrs*)**
This course introduce all Thermal and Hydrodynamic equipment's that includes but not limited to the design and selection of the flowing items: boilers, heat exchangers, piping system and fitting, burners, pumps,…etc. that includes the operation and maintenance for these equipment …etc. **Prerequisites: ENE321.**	

ENE462: Applied Refrigeration	**(3 *Cr. Hrs*)**
The vapor compression cycle. Alternative cycles: The absorption cycle, multiple effect cycles, ejector cycles, expansion cycles, electric and magnetic cycles. Refrigerants: the properties, refrigerant mixtures. Refrigeration system components. **Prerequisite: ENE321**	

CME331: Electromagnetics 1	**(3 *Cr. Hrs*)**
Review of Vector analysis and calculus, static electric and magnetic fields, capacitance and inductance. Maxwell's equations solutions, reflection and refraction of plane waves in dielectric and conducting media, transmission lines; transients and frequency domain solutions in loss and lossless lines, Smith chart and its applications, parallel plate and rectangular waveguides. **Prerequisites: ENE211**	

ENE511: Special Electrical Machines	**(3 *Cr. Hrs*)**
Linear electric machines: comparison with rotating machines. Linear induction motor: simplified electromagnetic field theory, force equation, characteristics. Superconducting ac generators and motors. Variable reluctance motors: performance and characteristics. Printed circuit motors. **Prerequisite: ENE311**	

ENE513: Power Systems Operation and Control	**(3 *Cr. Hrs*)**
General characteristics of modern power systems, evolution of power systems, power system control. Equipment characteristics and modeling, excitation systems, DC-excitation system, AC excitation system, control of protective functions, modeling of excitation system. Prime mover and energy supply systems. Hydraulic turbine and governor systems. Steam turbine and governor systems. Wind turbine control. Control of active and reactive power; modern stability of power systems; linear and nonlinear systems. **Prerequisite: ENE415**	

ENE517: Power Systems Protection	**(3 *Cr. Hrs*)**
Introduction and Review (Power system modeling, Symmetrical components, Three phase faults, Asymmetric faults, Fault transients, Transformer in-rush currents, Motor starting transients, Effects of grounding, High impedance faults), Relaying Instrumentation (Instrument transformers VTs and CTs, Characteristic of VTs and CTs), Protection Fundamentals (Overcurrent protection, Overvoltage / under voltage protection, Under frequency / over frequency protection, Zone distance protection, Differential protection, Pilot relaying, Computer relaying), Protective Relaying Applications (Generator protection, Motor protection, Transformer protection, Bus protection, Line production - network, radial Reactor and shunt capacitor protection). **Prerequisite: ENE415**	

ENE518: High Voltage Engineering	**(3 *Cr. Hrs*)**
Topics include introduction to high-voltage engineering; calculation methods of electric field strength, Discharge phenomena in gaseous, fluid and solid insulation materials, evaluation of onset and breakdown voltage of technical device, generation of high voltages (AC, DC, impulse, pulse); measurements of high voltages; destructive and nondestructive insulation test techniques; shielding and grounding; electric shock and safety. **Prerequisite: ENE415**	

ME554: Programmable Logic Controllers	**(3 *Cr. Hrs*)**
Theoretical and applied material, including: application and hardware composition of programmable logic controllers; functional programming blocks such as logic gates including AND, OR etc. as well as latches, timers, counters, and analog blocks; design approaches based on Boolean and structured logic, state machines, flowcharts; programming methodologies including: ladder diagrams, blocks and text-based. **Prerequisite: ME344**	

Tentative course schedule

First Year- First Semester				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
ENGL98	English *	0	-	
GER101	German I	3	-	
CS116	Computing fundamentals	3	-	
CS1160	Computing fundamentals lab	1	-	*CS116*
MATH101	Pre-math or Calculus I**	3	-	
PHYS103	Physics I	3	-	
CHEM103	General Chemistry	3	-	
CHEM106	General chemistry lab	1	-	*CHEM103*
MILS100	Military Sciences	3		
	Total	*20*		

First Year- Second Semester				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
ENGL99	English *	0	ENGL98	
GER102	German II	3	GER101	
MATH102	Calculus II	3	MATH101	
PHYS104	Physics II	3	PHYS103	
PHYS106	General Physics lab	1	-	*PHYS 104*
NE101	National Education	3	-	
ME111	Computer Aided Engineering Drawing	3	CS116	
IE121	Engineering Workshop	1	-	*ME111*
ARB 100	Arabic	3	-	
	Total	20		

***Placement test determines English course level.** ****Placement test determines math course level.**

First Year- Summer Semester				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
Univ Elective I	See Table in item (1.2) above	3		
	Any course from first year tables above student could not take and/or pass			
	Total	*3*		

Second Year- First Semester				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
ENGL101	English*	1	ENGL99	
GER201	German III	3	GER102	
TME212	Statics	3	PHYS103, MATH102	
ENE211	Electrical Circuits I	3	PHYS104	
MATH231	Probability & Statistics for Engineers	3	MATH102	
MATH203	Applied Mathematics for Engineers	3	MATH 102	
Univ Elective I	See Table in item (1.2) above	3		
	Total	*19*		

Second Year- Second Semester				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
ENGL102	English*	1	ENGL101	
GER202	German IV	3	GER201	
ENE212	Electric Circuits II	3	ENE211	
ENE213	Electronics	3	ENE211	
ENE214	Electric Circuit lab	1	ENE211	
MATH205	Differential Equations	3	MATH102	
TME213	Mechanics of Materials	3	TME212, TME214	
TME214	Dynamics and Vibration	3	TME212	
	Total	*20*		

***Placement test determines English course level.**

Second Year- Summer Semester				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
	Any course from second year tables above student could not take and/or pass	0		
	Total	*0*		

Third Year- First Semester				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
ENGL201	English*	2	ENGL102	
GER301	German V	3	GER202	
TME221	Thermodynamics	3	MATH102, CHEM103	
TME222	Fluid Mechanics	3	MATH205	
ENE323	Fluid Mechanics Lab	1	-	*TME222*
ENE312	Power Electronics	3	ENE213	
ENE314	Power Electronics Lab	1	-	*ENE312*
ME344	Control Systems I	3	ENE211, MATH205	
	Total	19		

Third Year- Second Semester				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
ENGL202	English*	2	ENGL201	
ENE311	Electrical Machines	3	ENE212	
ENE313	Electrical Machines Lab	1		*ENE311*
ENE321	Heat Transfer	3	TME222, TME221	
ENE322	Thermal Science Lab	1		*TME222, TME221*
GER302a	German VI: Fundamentals of Renewable Energy systems (Deutsch)	3	GER301, TME 222	
ENE431	Energy Conversion	3	TME222, ENE321	
ENE432	Power Plants Engineering	3	TME222, ENE321	
	Total	19		

Third Year- Summer Semester				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
ENE399	Field Training**	0		
	Total	*0*		

***Placement test determines English course level.**

****Prerequisite to fourth year in Germany, training duration 4 weeks with minimum 2 weeks continuous.**

Specialization

A: Renewable Energy Engineering Specialization

Fourth Year- First Semester				
Course No.	**Course Title**	**Cr. hr.**	**Prerequisite**	**Co-requisite**
One course from table 4.1	Technical Elective (Mandatory)	3	*See table 4.1*	
One course from table 4.1	Technical Elective (Mandatory)	3	*See table 4.1*	
One course from table 4.1	Technical Elective	3	*See table 4.1*	
One course from table 4.1	Technical Elective (general tech. elective)	3	*See table 4.1*	
	Total	*12*		

Fourth Year- Second Semester				
Course No.	**Course Title**	**Cr. hr.**	**Prerequisite**	**Co-requisite**
ENE499	Industrial Internship	12	*ENE 399*	
	Total	*12*		

Fifth Year- First Semester				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
ENE433	Solar Energy I	3	ENE431	
ENE435	Wind Energy Technology	3	ENE431	
ENE532	Energy lab	1	ENE431	
ENE536	Energy Engineering Economics	3	ENE431	
ME346	Instrumentations and Measurements	2	ENE211, MATH205	
ME347	Instrumentations and Measurements Lab	1		*ME346*
ENE598	Graduation Project I	1	-	
TME515	Mechanical Vibrations	3	TME214, MATH205	
IE333	Numerical Analysis for Engineers	3	CS116, MATH203, MATH205	
	Total	*20*		

Fifth Year- Second Semester				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
ENE434	PV Technology	3	ENE431	
ENE436	Renewable Energy lab	1	ENE431, ENE312, ENE311	
ENE515	Electrical Power Generation, Transmission & Distribution	3	ENE311	
ENE537	Energy Efficiency, management and laws	3	ENE431	
ENE571	Modeling and simulation techniques of energy systems	3	CS116, MATH205, IE333	
ENE599	Graduation Project II	3	ENE598	
	Total	*16*		

B: Electrical Power Engineering Specialization

Fourth Year- First Semester				
Course No.	**Course Title**	**Cr. hr.**	**Prerequisite**	**Co-requisite**
One course from table 4.2	Technical Elective (Mandatory)	3	*See table 4.2*	
One course from table 4.2	Technical Elective (Mandatory)	3	*See table 4.2*	
One course from table 4.2	Technical Elective	3	*See table 4.2*	
One course from table 4.2	Technical Elective (general tech. elective)	3	*See table 4.2*	
	Total	*12*		

Fourth Year- Second Semester				
Course No.	**Course Title**	**Cr. hr.**	**Prerequisite**	**Co-requisite**
ENE499	Industrial training	12	*ENE 399*	
	Total	*12*		

Fifth Year- First Semester				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
ME346	Instrumentations and Measurements	2	ENE211, MATH205	
ME347	Instrumentations and Measurements Lab	1		*ME346*
ENE516	Smart-Grid Power Systems	3	ENE312	
TME515	Mechanical Vibrations	3	TME214, MATH205	
ENE541	Real Time Computer Control Systems	3	ME344	
ENE598	Graduation Project I	1	-	
ENE536	Energy Engineering Economics	3	ENE431	
ENE532	Energy lab	1	ENE431	
ENE515	Electrical Power Generation, Transmission & Distribution	3	ENE311	
	Total	*20*		

Fifth Year- First Semester				
Course No.	Course Title	Cr. hr.	Prerequisite	Co-requisite
ENE411	Electric Drives	2	ENE311	
ENE416	Communication Systems and Networking	3	CS116	
Univ Elect. II	See Table in item (1.2) above	3	-	
CME343	Digital Electronics	3	ENE213 or CME241	
ENE415	Power Systems	3	ENE311, ENE212, IE333	
ENE599	Graduation Project II	3		
ENE544	Thermal power plant component*	3	ENE 432	
	Total	*19*		