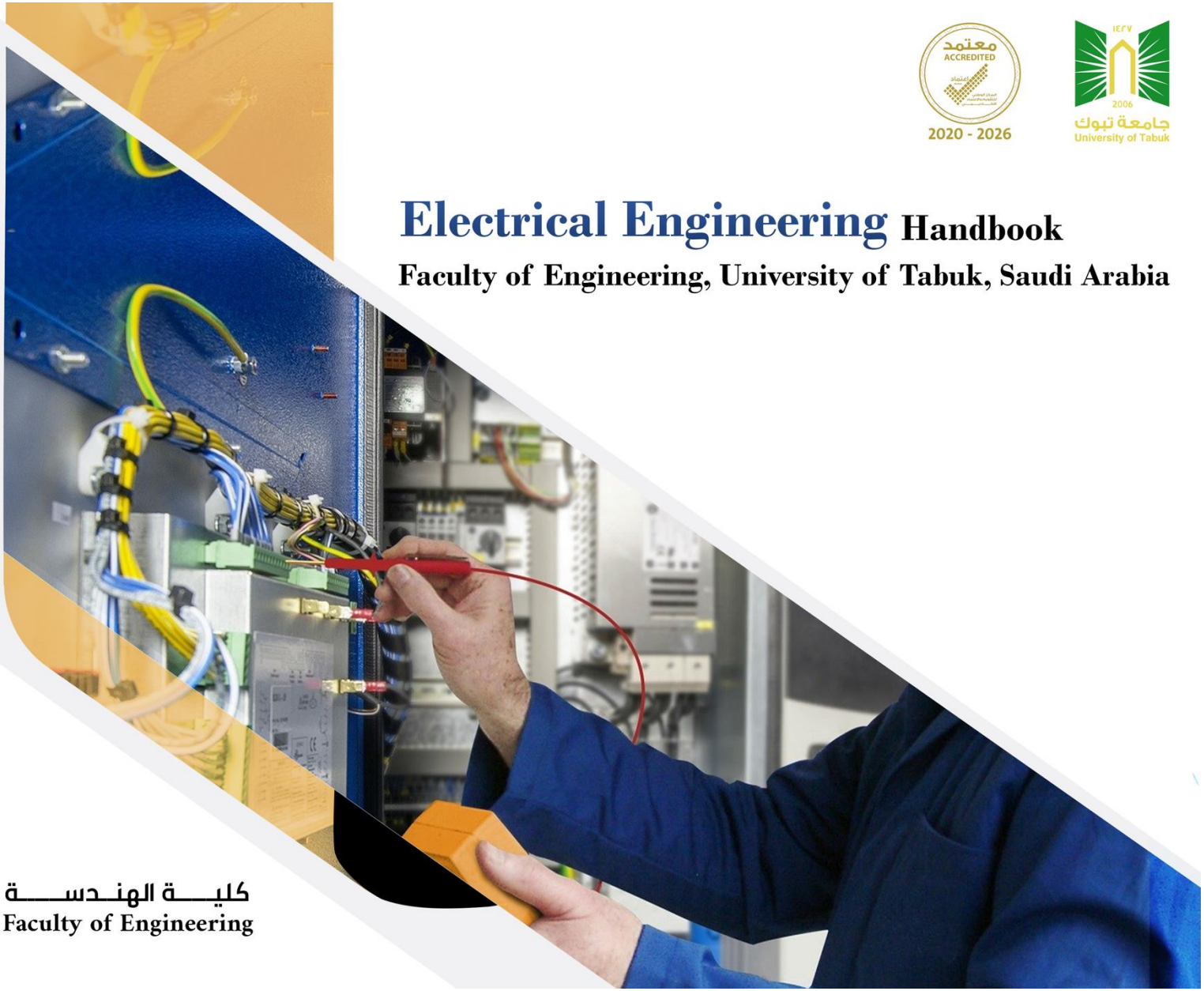


Electrical Engineering Handbook

Faculty of Engineering, University of Tabuk, Saudi Arabia

كليـــة الهنـدســـة
Faculty of Engineering


بسم الله الرحمن الرحيم

Chairman's Message

On behalf of the faculty and staff, I extend a warm welcome to all students joining the Electrical Engineering Department at our esteemed institution. As the Chairman of the department, it is my honor to guide and support you throughout your academic journey. Electrical engineering is a field that holds immense importance in shaping the world we live in. From designing innovative electronic systems to developing sustainable energy solutions, electrical engineers play a vital role in creating a better future. Our department is committed to providing you with a comprehensive education that encompasses both theoretical knowledge and practical skills necessary for success in this dynamic profession.

This student handbook serves as a valuable resource to acquaint you with the policies, procedures, and guidelines specific to our department. It is designed to provide you with important information that will aid in your academic and personal success. I encourage you to read through the handbook thoroughly and refer to it whenever you have questions or need clarification. The student handbook is not only a reference guide but also a tool for empowerment. It is our hope that by familiarizing yourself with its contents, you will feel confident and supported as you navigate your academic journey.

Once again, I extend my warmest welcome to all the new and returning students of the Electrical Engineering Department. Together, let us strive for excellence and create a positive impact on society through the remarkable field of electrical engineering.

Dr. Khaled Alatawi

Chairman, Department of Electrical Engineering

Department of Electrical Engineering (CE)

On December 11th of the year 2006, the Council for Higher Education approved establishing the Faculty of Engineering at the University of Tabuk in its decision No. (13/44/1427). Afterwards, the Department of Electrical Engineering was established in 2008. The Department was established, in fact, to keep up with the continuous development taking place in the Kingdom of Saudi Arabia in many industrial sectors. It was a necessity to establish an undergraduate Electrical Engineering (ELEN) Bachelor of Science (B.Sc.) program to cope up with the progress in scientific and technological advancements as well as the future demand for electrical engineers. Presently, the department grants distinctions for both a Bachelor of Science in Electrical Engineering and a Master's degree in Renewable Energy. The department has very well-equipped laboratories that can be used by the students to run experiments within the curriculum and by faculty members to conduct research. In addition, the department has advanced computing facilities to assist students and faculty members in their daily work. The department computing facilities are equipped with several design, simulation, and control packages that are used by the students to simulate electrical engineering systems.

Department Vision

To become a leading department that produces ethical and professional leaders who are equipped with the skills and knowledge to drive societal and economic growth through innovative research and development.

Department Mission

To offer programs that emphasize research and development, instill moral values and ethical behavior, and promotes professionalism and societal economic prosperity in a supportive environment.

Department Goals

1. Offer undergraduate and graduate programs that contribute to the advancement of industry.
2. Foster a culture of ethical and responsible conduct among students, faculty, and staff.
3. Provide a supportive learning environment that helps students to acquire the skills and competencies needed to succeed in their careers.
4. Establish partnerships with industry, government, and other stakeholders to facilitate the transfer of knowledge and technology.
5. Continuously assess and improve program offerings, teaching methodologies, and support services to ensure that they are relevant, effective, and responsive to the evolving needs of students, industry, and society.

Bachelor of Science in Electrical Engineering Program

The program started in the academic year of 2008. The program is a five-year (i.e., 10 semesters) program that is offered only for male students and requires a successful completion of 164 credit hours before graduation. The duration of each semester is nineteen weeks including final exams period. Students are required to complete one summer of practical training in the industry under the supervision of both the EE department and the host company where their performance is assessed during and at the end of the training.

B.Sc. in EE Program Mission

To offer a comprehensive education that develops technical and professional engineering skills, instills moral values and ethical behavior, and motivates and prepares students to engage in research and community service.

B.Sc. in EE Program Goals

1. Produce competent Electrical Engineers.
2. Inculcate moral values and professionalism among students.
3. Engage students in community services.
4. Empower graduates to contribute towards economic prosperity of the country.

B.Sc. in EE Program Learning Outcomes (PLOs)

1. An ability to demonstrate knowledge and comprehension with both breadth and depth in the underlying theories, principles, and concepts of electrical engineering and science.
2. An ability to identify, formulate, and solve complex engineering problems by applying principles of electrical engineering, science, and mathematics.
3. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
4. An ability to develop and conduct appropriate experimentation, analyze, and interpret data, and use engineering judgement to draw conclusions.
5. An ability to communicate effectively with a range of audiences.
6. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgements, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
7. An ability to function effectively on a team, whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
8. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

University of Tabuk Admission Guidelines

Weblink: Admission Guide

Program Admission Requirements

1. Pass all preparatory year courses.
2. After completing 45 credit hours (completing the Level 3-second year), the student can choose from the four engineering programs offered (Civil, Mechanical, Electrical, and Industrial).
3. Applications are submitted electronically through the student's academic portal.
4. Admissions are based on students' GPA , selections and the program's capacity, as approved by the Faculty of Engineering Council for that academic year.
5. Dean Approval.

Faculty of Engineering Admission Process Video

WebLink: Program Admission Process

Student Academic Guide

Weblink: Student Academic Guide

Study and Tests Regulations

https://www.ut.edu.sa/ar/Deanship/dar/Documents/S.R.444.pdf

Students Complaints and Grievances Guide

WebLink: Complaints and Grievances Guide

Academic Advising

Academic Advising is an essential and central pillar of the educational system, and focuses on the two axes of the educational process: the educational institution and the student. This role is strengthened by the specialized academic advisor. Students have the option to communicate with their academic advisors through in-person meetings, email, or by utilizing the virtual services offered by the university.

Academic Advising Guide

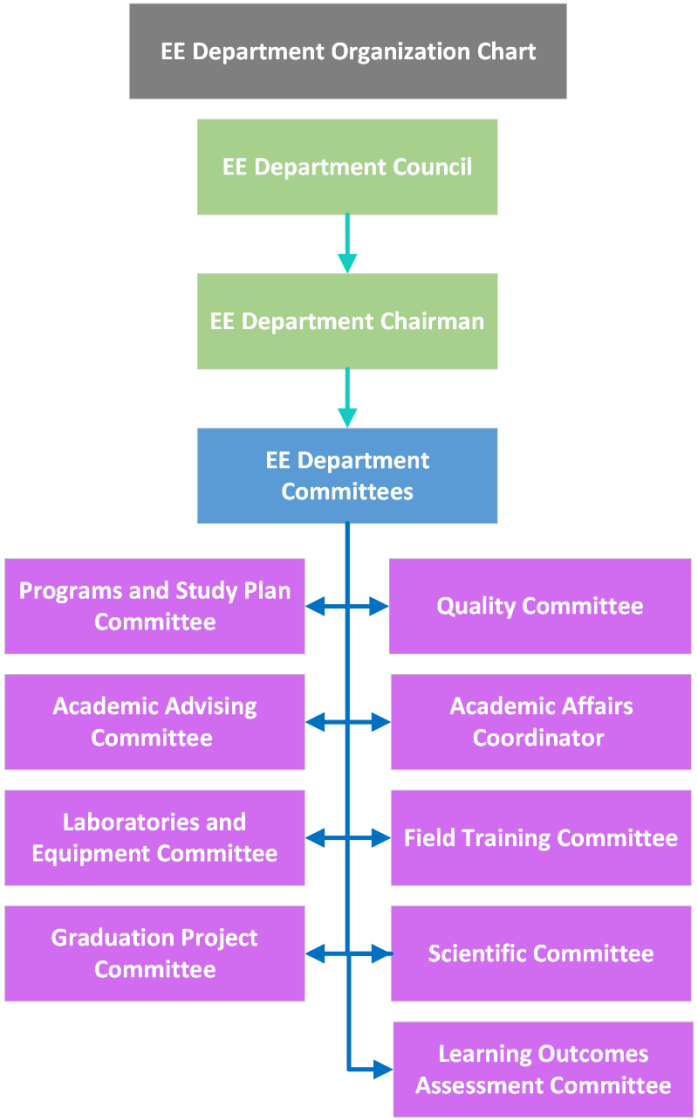
WebLink: Academic Advising Guide

Virtual Academic Advising

https://tabuk.blackboard.com/

https://myut.ut.edu.sa/

Organizational Structure



Degree Requirements

The EE B.SC. curriculum is structured in such a way to provide EE graduates with the necessary technical and professional experience for serving and developing society. To obtain a B.Sc. degree in Electrical Engineering, the student must successfully complete 164 credit hours across 10 levels (semesters) of study (5 years), in which 2 credit hours are assigned for practical summer training (8 weeks) in the industry.

The curriculum (164 credit hours) includes 45 credit hours for university requirements (General Education, Mathematics, and Science), 32 credit hours for faculty requirements (General Engineering, Mathematics, and Science), and 87 credit hours for department requirements (69 credit hours for compulsory core course, 12 credit hours for elective courses, 4 credit hours for senior design project (SDP), and 2 credit hours for summer practical training).The table below shows an overall summary the of requirements to obtain the degree.

	Course Title	Course Code	Credit
1	University Requirements	Compulsory	45
2	Faculty of Engineering Requirements	Compulsory	32
3	Electrical Engineering Department Requirements	Compulsory	75
		Electives	12
Total			**164**

General Education Requirements

EE students are required to complete 34 credit hours of General Education courses required by the University and the college. These courses support the students' communication skills and enable them to behave professionally and ethically in multidisciplinary work environments.

	Course Title	Course Code	Credit	Prerequisites
1	English for Technical Fields (1)	ECE001	5	-
2	English for Technical Fields (2)	ECE002	5	ECE002
3	Communication Skills	COMM001	2	-
4	Learning, Thinking, and Research Skills	LTS001	3	-
5	Computer Skills and Applications	CSC001	3	-
6	Language Skills	ARB101	2	-
7	Writing Skills	ARB201	2	ARB101
8	Islamic Cultural (1)	ISLS 101	2	-
9	Islamic Culture (2)	ISLS 201	2	ISLS 101
10	Islamic Culture (3)	ISLS 301	2	ISLS 201
11	Islamic Culture (4)	ISLS 401	2	ISLS 301
12	Engineering Economy	ENG214	2	ENG213
13	Engineering Management	ENG215	2	ENG214
Total			**34**	

General Engineering Requirements

EE students are required to complete 34 credit hours of Engineering fundamentals requirements as listed in the Table below. The majority of these courses must be completed prior to taking EE core courses.

	Course Title	Course Code	Credit
1	Engineering Drawing and Graphics	ENG201	3
2	Production Technology and Workshops	ENG202	3
3	Engineering Mechanics (1)	ENG203	2
4	Introduction to Engineering Design (1)	ENG205	3
5	Introduction to Engineering Design (2)	ENG213	2
Total			**13**

Mathematics and Basic Sciences Requirements

All Electrical Engineering students require a strong Mathematics and basic Science background. This is achieved by taking 36 credit hours distributed across the thirteen courses listed in the Table below:

	Course Title	Course Code	Credit
1	Mathematics	MATH100	3
2	Mathematics (2)	MATH101	3
3	Mathematical Geometry	MATH284	3
4	Differential Equations	MATH383	3
5	Linear Algebra	MATH241	3
6	Complex Analysis and Discrete Math	ELEN220	3
7	Numerical Methods	ELEN322	3
8	General Physics	PHYS101	3
9	Physics	PHYS 205	4
10	General Biology	BIO101	3
11	General Chemistry	CHEM101	3
12	General Chemistry Lab	CHEM203	1
13	General Physics Lab	PHYS281	1
Total			**36**

Electrical Engineering Requirements

The curriculum of the EE program has been adapted to let students have the opportunity to specialize, up to a certain depth, in the following three concentration areas. These areas cover the full spectrum of Electrical Engineering activities .

This is achieved by a set of compulsory and elective courses. A list of the EE compulsory courses is presented in the below table:

	Course Title	Course Code	Credit
1	Electrical Circuits I	ELEN200	3
2	Electrical Circuits II	ELEN202	3
3	Measurements and Instruments	ELEN204	2
4	Circuit Lab	ELEN203	1
5	Electronics I	ELEN210	3
6	Electronics II	ELEN310	3
7	Electronics Lab	ELEN311	1
8	Probabilistic Methods in EE	ELEN224	3
9	Engineering Programming	ELEN326	3
10	Signals and Systems	ELEN230	3
11	Control Systems	ELEN232	3
12	Control Lab	ELEN233	1
13	Digital Signal Processing	ELEN330	3
14	Electromagnetics I	ELEN240	3
15	Electromagnetics II	ELEN340	3
16	Electromagnetics Lab	ELEN341	1
17	Logic Design	ELEN250	3
18	Logic Design Lab	ELEN251	1
19	Embedded Systems	ELEN352	4
20	Communication Engineering I	ELEN260	3
21	Communications Lab	ELEN361	1
22	Electrical Machines	ELEN370	3
23	Electric Energy Engineering	ELEN372	3
24	Electric Machines and Energy Lab	ELEN373	1
25	Scientific computing	ELEN331	2
26	Power Electronics	ELEN410	3
27	Graduation Project I	ELEN495	1
28	Graduation Project II	ELEN496	3
29	Summer Training	ELEN399	2
Total			**69**

Electrical Engineering Elective Courses

The elective courses offered in the Electrical Engineering program are chosen and designed to serve the Electrical Engineering graduate in his career after graduation. They are designed to provide the senior Engineering student with a realistic understanding of the Engineering design process and synthesis in addition to other Engineering skills required to prepare students for Engineering practice. Students must choose four elective courses each in the final year, based on their interest to work in a specific field.

A. Electric Machines and Power Systems

	Course Title	Course Code	Credit
1	Power Electronics Applications	ELEN412	3
2	Power Systems Analysis	ELEN474	3
3	Renewable Energy & Smart Grids	ELEN476	3
4	Protection of Power Systems	ELEN472	3
5	Special Electric Motors	ELEN478	3
6	Fundamentals of Energy Efficiency	ELEN480	3
7	High Voltage Engineering.	ELEN482	3

B. Electronics and Communications

	Course Title	Course Code	Credit
1	Communication Engineering II	ELEN360	3
2	Antennas	ELEN440	3
3	Wireless Communications	ELEN462	3
4	Optical Communication	ELEN464	3
5	Satellite Communications	ELEN466	3
6	Data Networks	ELEN468	3

C. Control Systems

	Course Title	Course Code	Credit
1	Industrial Automation	ELEN432	3
2	Industrial Motor Control	ELEN436	3
3	Power Systems Operation and Control	ELEN470	3

D. All Areas

	Course Title	Course Code	Credit
1	Selected Topics in Electrical Eng.	ELEN490	3
2	Selected Topics in Electrical Eng. (1)	ELEN491	3
3	Selected Topics in Electrical Eng. (2)	ELEN49	3

Electrical Engineering Program Study Plan

1. 1st Level

	Course Title	Course Code	Contact Hrs		CRs	Prereq.
			Lec.	Lab		
1	English Language Skills I	ECE001	15	0	5	-
2	Learning & Thinking Skills	LTS001	3	0	3	-
3	General Biology	BIO101	3	0	3	-
4	Chemistry	CHEM101	3	0	3	-
5	Mathematics I	MATH100	3	0	3	-
Total			29	0	17	

2. 2nd Level

	Course Title	Course Code	Contact Hrs		CRs	Prereq.
			Lec.	Lab		
1	Comm. Skills	COMM001	2	0	2	-
2	Computer Skills & Applications	CSC001	3	0	3	-
3	English Language Skills (2)	ECE002	15	0	5	ECE001
4	Mathematics II	MATH101	3	0	3	MATH100
5	General Physics	PHYS101	3	0	3	-
Total			26	0	16	

3. 3rd Level

	Course Title	Course Code	Contact Hrs		CRs	Prereq.
			Lec.	Lab		
1	Eng. Drawing and Graphics	ENG201	3	0	3	-
2	Eng. Mechanics (1)	ENG203	2	0	2	PHYS101
3	Introduction to Eng. Design (1)	ENG205	2	2	3	MATH101 ECE002
4	Islamic Culture I	ISLS101	2	0	2	-
5	Mathematical Geometry (3)	MATH284	3	0	3	MATH101
6	Physics	PHYS205	3	2	4	PHYS101
7	General Phys Lab	PHYS281	0	2	1	PHYS101
Total			15	6	18	

4. 4th Level

	Course Title	Course Code	Contact Hrs		CRs	Prereq.
			Lec.	Lab		
1	Electrical Circuits I	ELEN200	3	0	3	MATH101 PHYS205
2	General Chem. Lab	CHEM203	0	2	1	CHEM101
3	Introduction to Eng. Design (2)	ENG213	2	0	2	ENG205
4	Complex Analysis and Discrete Math	ELEN220	3	0	3	MATH101
5	Linear Algebra	MATH241	3	0	3	MATH284
6	Production Tech. and Workshops	ENG202	3	0	3	ENG201
7	Differential Equ.	MATH383	3	0	3	MATH284
Total			17	1	18	

5. 5th level

	Course Title	Course Code	Contact Hrs		CRs	Pre(Co)req.
			Lec.	Lab		
1	Electrical Circuits II	ELEN202	3	0	3	ELEN200
2	Electric Circuits Lab	ELEN203	0	3	1	ELEN202, 200(Co)
3	Electronics I	ELEN210	3	0	3	ELEN200
4	Logic Design	ELEN250	3	0	3	ELEN200
5	Signals and Systems	ELEN230	3	0	3	ELEN200 MATH241
6	Electromagnetics I	ELEN240	3	0	3	PHYS205 MATH284
Total			15	1	16	

6. 6th level

	Course Title	Course Code	Contact Hrs		CRs	Pre(Co)req.
			Lec.	Lab		
1	Electromagnetics II	ELEN340	3	0	3	ELEN240 MATH383
2	Electromagnetics L.	ELEN341	0	3	1	ELEN203,240, 340(Co)
3	Eng. Programming	ELEN326	2	3	3	CSC001
4	Control Systems	ELEN232	3	0	3	ELEN230 MATH383
5	Electronics II	ELEN310	3	0	3	ELEN202,210
6	Electronic Lab	ELEN311	0	3	1	ELEN203,210, 310(Co)
7	Numerical Methods	ELEN322	3	0	3	MATH241
8	Logic Design Lab	ELEN251	0	3	1	ELEN250,203
Total			14	12	18	

7. 7th level

	Course Title	Course Code	Contact Hrs		CRs	Pre(Co)req.
			Lec.	Lab		
1	Engineering Econ.	ENG214	2	0	2	ENG213
2	Prob. Methods in EE	ELEN224	3	0	3	ELEN230
3	Embedded Systems	ELEN352	3	3	4	ELEN326,250
4	Electrical Machines	ELEN370	3	0	3	ELEN202 ,340
5	Islamic Culture II	ISLS201	2	0	2	ISLS101
6	Control lab	ELEN233	0	3	1	ELEN232,203
7	Scientific Computing	ELEN331	2	0	2	MATH241 ELEN200
Total			15	6	17	

8. 8th level

	Course Title	Course Code	Contact Hrs		CRs	Pre(Co)req.
			Lec.	Lab		
1	Measurements &inst.	ELEN204	2	0	2	ELEN310
2	Comm. Eng. I	ELEN260	3	0	3	ELEN224,230
3	Electric Energy Eng.	ELEN372	3	0	3	ELEN370
4	Electric Machines & Energy Lab	ELEN373	0	3	1	ELEN372(Co) ,203
5	Summer Training	ELEN399	0	0	2	-
6	Language Skills	ARB101	2	0	2	-
7	Islamic Culture III	ISLS301	2	0	2	ISLS201
8	Eng. Management	ENG215	2	0	2	ENG214
Total			14	3	17	

9. 9th level

	Course Title	Course Code	Contact Hrs		CRs	Pre(Co)req.
			Lec.	Lab		
1	Digital Signal Processing	ELEN330	3	0	3	ELEN230
2	Communication Engineering Lab	ELEN361	0	3	1	ELEN260 - ELEN203
3	Power electronics	ELEN410	3	0	3	ELEN310
4	Graduation Project I	ELEN495	0	2	1	ELEN311 - ELEN370 - ENG213
5	Writing Skills	ARB201	2	0	2	ARB101
6	Elective 1	ELEN4xx	3	0	3	-
7	Elective 2	ELEN4xx	3	0	3	-
Total			**14**	**5**	**16**	

10. 10th level

	Course Title	Course Code	Contact Hrs		CRs	Pre(Co)req.
			Lec.	Lab		
1	Graduation Project II	ELEN496	0	6	3	ELEN495
2	Islamic Culture IV	ISLS401	2	0	2	ISLS301
3	Elective 1	ELEN4xx	3	0	3	-
4	Elective 2	ELEN4xx	3	0	3	-
Total			**8**	**6**	**11**	

Senior Design Project

The senior design project (SDP) is an emulation of real-life engineering projects where students develop their technical and professional skills and apply their knowledge to solve a complicated engineering problem. The project is designed to enable the students to practice their research and problem-solving skills and enhance their communication, teamwork, time management and project planning skills. Furthermore, it emphasizes students' understanding of safety polices, ethical issues, conflict of interest as well as social and environmental impacts of engineering solutions.

Students undertaking senior design project work under the direct supervision of a faculty advisor. The students are expected to work on a team on an engineering problem, conduct sufficient literature survey, recognize the objectives of their work and identify any relevant constraints, perform experiments, build prototypes and/or produce simulations as appropriate to their problem, analyze the results and present their work in the form of a report and a presentation.

Steps to Assign Senior Project

Students registered for the course apply for available projects individually or as a team. Students interested in a specific problem may approach a faculty member whose specialty is compatible with the proposed project before the beginning of the term for approval.

The process for project proposals and registration are as follows:

1. Supervisors submit the senior project proposal (SDP Proposal Form).

2. Proposals are presented in a department meeting for approval.

3. Approved proposals are announced to the students for the selection process.

4. Students may apply for one or more of the approved projects (SDP Application Form).

5. If the number of students apply for a project exceeds five, the five students with highest GPAs will be selected.

6. Students are registered with the designated faculty member

Senior Design Project Perquisites and Duration

Students must complete at least 120 credit hours as well as certain courses depending on the field of study prior registering for Senior Design Project I. Then, the student continues their project in Senior Design Project II. The completion of senior design project requires two semesters (1 academic year).

WebLink: Senior Design Project Guide

Field Training:

In order to allow students to experience a real-life Engineering career environment, summer training is offered in the EE program. The Electrical Engineering curriculum requires students to complete eight weeks of summer training in the industry, either at private or government Engineering environments. This training is a compulsory component of graduation requirements. Summer training gives students the chance to combine formal classroom study with relevant practical experience.

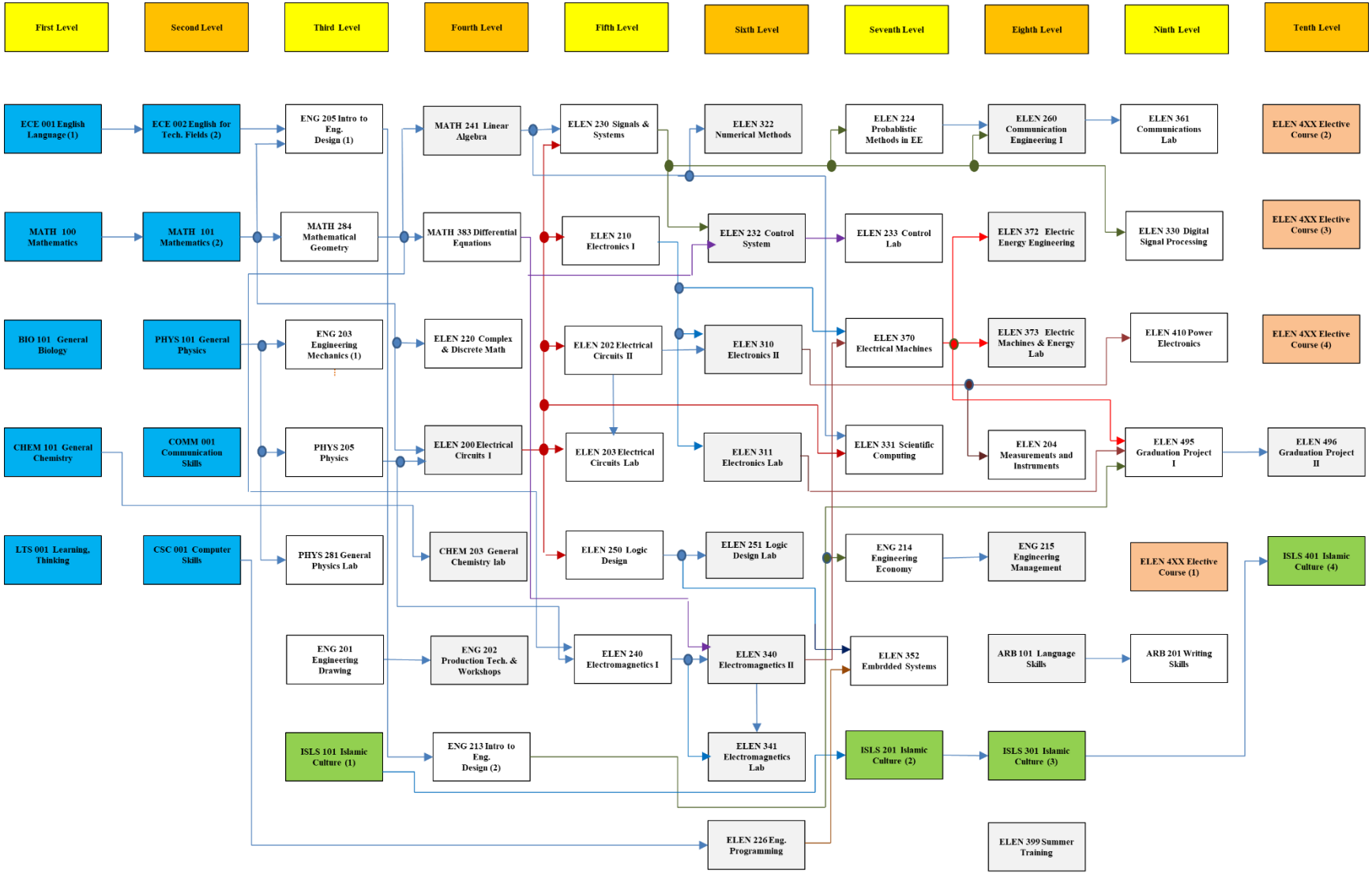
Steps to apply for Field Training

1. Students must complete at least 120 Credit hours.
2. Students are required to select the companies they wish to undergo training with through the following link, which is available on the faculty's website. Using University ID and National ID

   https://gate.ut.edu.sa/etrainingstudents/login.aspx
3. During the training, the student is required to submit a weekly report form to their advisor. In this form, the student documents their activities and tasks undertaken during each week.
4. Students are expected to submit a comprehensive report that includes the knowledge and skills they have acquired during the training. The deadline for submitting this report to their advisor.

WebLink: Field Training Guide

EE Curriculum Flowchart



- ELEN 203 is a prerequisite for all Labs

Faculty Members

Faculty Name	Rank	Area of Expertise	Email
Ibrahem E. Atawi	Associate Professor	Power Systems Control & Renewable Energy	ieatawi@ut.edu.sa
Khaled Alatawi	Assistant Professor	Electrical Power Engineering	khaled@ut.edu.sa
Ahmed Alzahmi	Assistant Professor	Electronics and Communications	aalzahmi@ut.edu.sa
Fahad Almasoudi	Assistant Professor	Electrical Power Engineering	falmasoudi@ut.edu.sa
Fares Almehmadi	Associate Professor	Communications Engineering	fal_mehmadi@ut.edu.sa
Hani Albalawi	Associate Professor	Electrical Power Engineering	halbala@ut.edu.sa
Muawia Mahmoud	Associate Professor	Instrumentation and Control	mmahmoud@ut.edu.sa
Saeed Alzahrani	Assistant Professor	Electronics & Communication Engineering	saeedalzahrani@ut.edu.sa
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Mohammed Alhartomi	Associate Professor	Communications and Electronics Engineering	malhartomi@ut.edu.sa

Laboratories

The laboratories in use by the EE Department are housed in buildings 11 and 12 on the UT main campus. Each lab is used to serve the experimental component in one or more courses. A short description of these laboratories and equipment in each laboratory, courses served by each lab equipment are provided in detail in the next sections. The laboratories have adequate equipment for carrying out experimental work for courses, senior design projects and research. The laboratories are well maintained and regularly upgraded. The laboratories used by the EE program adequately support the curriculum delivery; These laboratories include:

Lab Name	Lab Location	Related Course
Electrical Circuits Lab	1-12-1-2	ELEN 203
Control Lab	1-12-1-7	ELEN 233
Digital Logic Lab	1-12-1-6	ELEN 251 ELEN352
Electronics Lab	1-12-1-9	ELEN 311
Electromagnetics Lab	1-11-1-11	ELEN 341
Communications Lab	1-11-1-11	ELEN 361
Electrical Machines and Energy Lab	1-12-0-3	ELEN 373
Computer Lab	1-11-1-5	ELEN326 ELEN331

Laboratories safety Policies and Procedures

WebLink: EE Laboratory and Safety Policies and Procedures

A. Electrical Circuits Lab

In this lab, students learn the basics of electrical engineering and become familiar with the components of the electrical circuit. They also learn how to measure electric current, voltage difference, and resistance and apply some electrical laws such as Ohm's law and Kirchhoff's law.

B. Control Lab

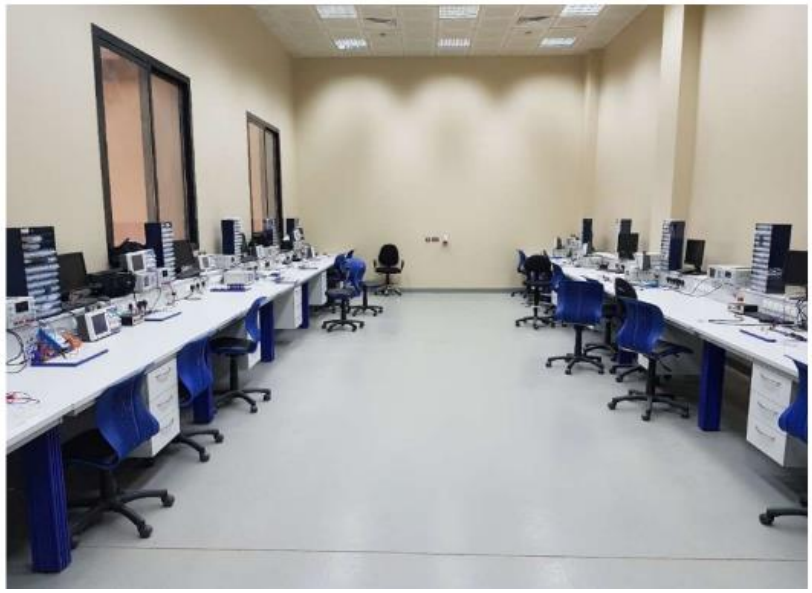
This lab contains the equipment that is necessary to conduct experiments about the basics of control and its application in different systems. They also learn how to adjust the controller to get the desired output.

C. Digital Logic Lab

In this lab, students learn the basics of designing and implementing combinational and sequential digital circuits and systems such as adders, encoders, multiplexers, and counters using logic gates.

D. Electronics Lab

In this lab, students learn the basics of electronics and its components such as diodes and transistors. They also learn how to build and test electronic circuits and some of their applications.



E. Electromagnetic Fields Lab

The Electromagnetic Fields Laboratory contains advanced equipment and software used to conduct experiments about antennas and electromagnetic field theories and their applications in the area of wave propagation, radiation, and radio communication.

F. Communications Lab

The lab includes devices that help students understand the theories of analog and digital communications and used in the broadcasting of radio stations of both AM and FM.

G. Electrical and Power Machines Lab

In this lab, students use different electrical measuring devices and components to conduct basic experiments about electrical power systems and study the general characteristics of power systems such as generators, motors, transformers, loads of various types, and transmission lines.

H. Computer Laboratory

The students of the EE department have access to a computer lab. The systems are supplied with all necessary software for the students to carry out their tasks. Total Number of PCs is 30 with total capacity of the laboratory maximum of 30 students. It is used for teaching different courses like Engineering Programming and Scientific Computing.

Useful Links:

1. Electrical Engineering Department

   https://www.ut.edu.sa/ar/Faculties/engineering/Electrical/Pages/default.aspx

2. UT Deanship of Students Affairs

   https://www.ut.edu.sa/en/Deanship/student-affairs/Pages/default.aspx

3. Saudi Council of Engineers
   https://www.saudieng.sa/English/Pages/default.aspx

4. Institute of Electrical and Electronics Engineers
   https://www.IEEE.gov

5. ASTM International-Standards Worldwide
   https://www.astm.org/

6. Electrical Enigneeing Portal
   https://electrical-engineering-portal.com/

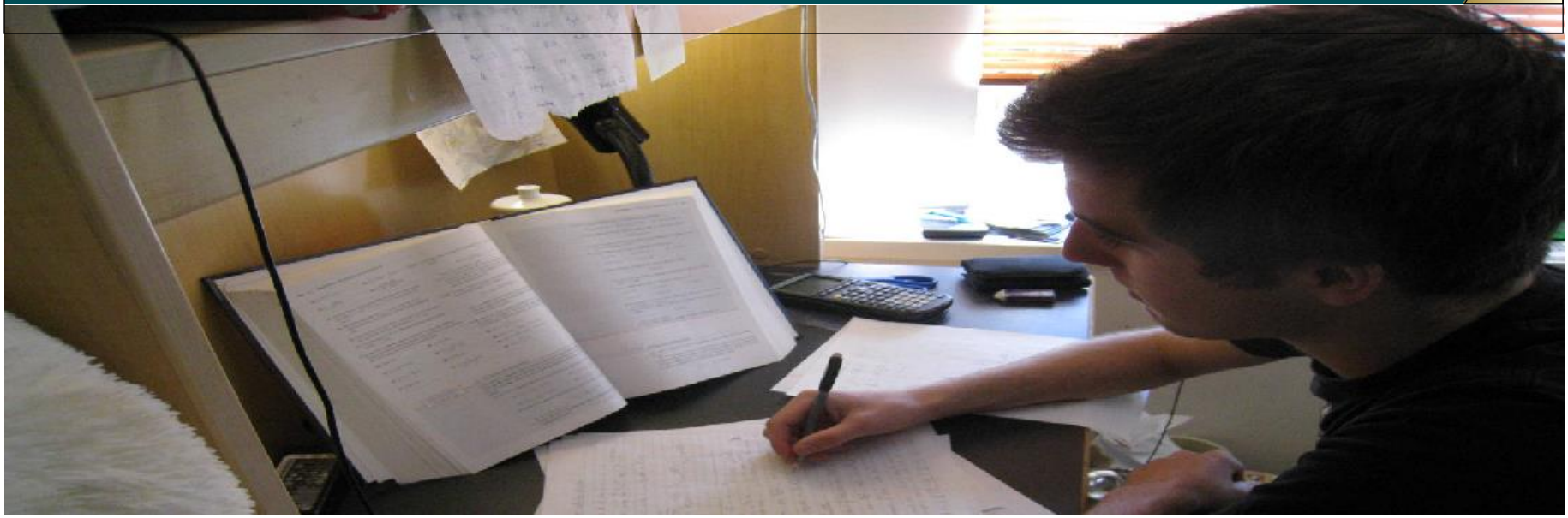
7. Association of Energy Engineers
   https://www.aeecenter.org/

8. The Renewable Energy Institute
   https://www.renewableinstitute.org/

9. Project Management Institute
   https://www.pmi.org/

10. National Renewable Energy Laboratory (NREL)
    https://www.nrel.gov/

APPENDIX: COURSES DESCRIPTION



General Courses

PHYS0205 Physics

Geometrical Optics: Nature and propagation of light; Refraction of light, Prisms, Reflection of light, Lenses, Lens aberration, image formation-paraxial approximation; optical instruments; superposition of waves; standing waves beats; Wave motion and sound; two-beam and multiple-beam interference; polarization; Fraunhofer and Fresnel diffraction; holography; lasers; Selected Topics in Modern Physics; nuclear physics; Experiments.

Prerequisite: PHYS0101

PHYS0281 General Physics Lab

Determination of thermal conductivity of a bad conductor; Determination of the coefficient of surface tension of a liquid; Determination of Young›s modulus; Determination of the coefficient of viscosity of a viscous liquid; Determination of shear modulus;

Comparison and determination of an EMF and R using potentiometer and meter – bridge; Determination of the resistivity of a material (metal wire).

Prerequisite: PHYS0101

CHEM0101 General Chemistry

Physical chemistry: Matter, atomic structure and the periodic table, chemical bonding, stoichiometry of pure substances, reaction in aqueous solutions, states of matter, gases, liquid state; Chemical equilibria; Chemical kinetics; Nuclear chemistry; Thermo- chemistry; Electrochemistry: corrosion of metals; Water treatment; Chemistry of cements; Chemistry of polymers; Fuels combustion; Pollution and its control; Experiments.

Prerequisite: None

MATH0284 Mathematical Geometry

Definite and indefinite integrals of functions of single variable; Applications of the definite integral; Fundamental theorem of calculus; Techniques of integration; Mean value theorems and Hospital›s rule; Integration and its applications in parametric and polar coordinates; Hyperbolic functions; Improper integrals; Sequences and series; Alternating series; Absolute and conditional convergence; Power series; Laplace transform.

Prerequisite: MATH0101

MATH0383 Differential Equations

Differential equations of the first order including basic concepts; Solving methods of differential equations; Differential equations of higher orders and their solutions; Euler›s equations and systems of linear equations; Solution by matrices: some applications; Fourier series; Partial differential equations including Alembert›s equations and separation of variables methods for solving heat; Wave and Laplace equations.

Prerequisite: MATH0284

MATH0325 Probability and Statistics

Descriptive statistics; Axiomatic probability; Random variables and their moments; Special discrete and continuous distributions; Sampling distributions; Estimation; Hypothesis testing; Linear regression; Analysis of variance; Analysis of categorical data.

Prerequisite: MATH0284

MATH0241 Linear Algebra

Systems of linear equations: matrices, determinants, inverse of a matrix, Cramer's rule. Vector spaces and subspaces; linear transformations; Determinants; Vectors in two and three dimensions: scalar and vector products; Equations of lines and planes in space, surfaces, cylindrical and spherical coordinates. Vector valued functions; Functions in two and three variables; Chain rule; Tangent planes and normal lines to surfaces; Extreme of functions of several variables, Lagrange multipliers.

Prerequisite: MATH0284

ENG0201 Engineering Drawing and Graphics

Engineering drawing techniques and skills; Orthographic projection of engineering bodies: points, lines, surfaces and bodies; Derivation of views from isometric drawings and vice versa; Derivation of views and sections from given views; Intersection of bodies and surfaces; Assembly drawings for some mechanical components; Introduction to Computer Aided Drawing (CAD); Fundamentals of engineering graphics in 2D and 3D drawings.

Prerequisite: None

ENG0202 Production Technology and Workshops

Introduction; Function and planning of workshops; Properties of engineering materials and their applications; Workshop metrology; Basic bench work operations; Machining operations; Tools; Equipment and machinery used in basic workshop processes: turning, milling, grinding, forging, sheet metal-work; Measurements: standardization, international measuring systems; Cost analysis and estimation of maintenance; Welding processes; Casting processes; Industrial safety; Workshops.

Prerequisite: ENG0201

ENG0203 Engineering Mechanics I

Basic concepts and principles of engineering mechanics; Vector analysis of forces; Moment and reduction of forces: moment and couples, reduction of a system force, equivalent system forces, equivalent couples; Equilibrium of particles in two and three dimensions; Equilibrium of rigid bodies; Friction and its applications; Analysis of trusses; Center of gravity and moment of inertia.

Prerequisite: PHYS0101

ENG0204 Engineering Mechanics II

Kinematics of a particle: rectilinear and curvilinear motion, and relative motion of a particles, plane motion of a rigid body; Dynamics of systems of particles: Newton›s laws of motion, equations of motion for rectilinear and curvilinear motion; Kinetics of particles: work and energy, impulse and momentum, and impact; Kinetics of a rigid body in plane motion: translation, fixed axis rotation, work and energy, impulse and momentum.

Prerequisite: ENG0203

ENG0205 Engineering Design I

Introduction to active learning: working in teams, team dynamic, team norms and communication, conducting effective meetings and quality assessment; Problem solving: problem definition, generation of solutions, selection methodology, solution implementation, assessment of implementation; Levels of learning and degrees of internalization; Ethical decision; Organization of the work and design notebook; Engineering history; Technology and environment; Engineering Professions.

Prerequisite: ECE0002-MATH0101

ENG0213 Engineering Design II

Engineering design process; Computer modeling of processes and products; Presentation, organization, and assessment of technical or Engineering work and the preparation of brief reports; quality principles; and self- regulation or the behaviors associated with taking personal responsibility for time management, learning new material, setting goals; Basic elements of technical report; Types of technical reports.

Prerequisite: ENG0205

ENG0214 Engineering Economy

Principles of engineering economy, Design and manufacturing processes, Cost terminology and estimation, Accounting, Balance sheet, Profit loss statement, Money time relationships, Simple and compound interest rates, Single amounts and uniform series, Increasing and decreasing gradient, Application of money, Time relationships, Present value, Internal and External rate of return, Payback period, Evaluation of alternatives for different useful life and study period, Depreciation methods, Replacement analysis, Determination of the economic life of challenger and defender,

Engineering economy techniques for evaluation of public projects; Requires final project and presentation.

Prerequisite: ENG0213

ENG0215 Engineering Management

Introduction to engineering management, Types and characteristics of production systems, Forecasting methods and techniques, Product design, Capacity planning, Aggregate planning, Inventory planning and materials management, Short term scheduling, Quality management and quality control, Job design and work methods, Project planning and scheduling.

Prerequisite: ENG0214- MATH0325

Electrical Engineering Courses

ELEN200 Electric Circuits I

Introduction to electric circuits theory; Ohm›s law; KVL; KCL; Circuit analysis using Mesh and Nodal methods; Circuit theorems: Thevenin's, Norton's, and superposition theorems; Inductance and capacitance; transient response of first order circuits.

Prerequisite: PHYS205,MATH101

ELEN202 Electric Circuits II

Operational Amplifiers, Sinusoids and Phasors, Sinusoidal Steady-State Analysis, AC Power Analysis, Three-Phase Circuits, Magnetically Coupled Circuits, Frequency Response, Two-port Networks.

Prerequisite: ELEN200

ELEN203 Electric Circuits Lab

This laboratory introduces the students to the Laboratory Safety and lab regulations, Electric components; Electric equipment: sources, multimeters, oscilloscopes; Measuring electric circuit parameters. In addition, students get to Verify basic laws and theorems of DC circuits; Record, evaluate, and analyze experimental data; Measure waveform parameters; Measure reactance and phase angle in RC and RL circuit; Use op-amp as Inverting amplifier, Non-inverting amplifier, Voltage follower, Differential amplifier, Integrator and differentiators.

Prerequisite: Pre ELEN200, Co ELEN202

ELEN 204 Measurements and Instrumentation

Fundamentals of measurements, types of errors, types of commonly used sensors, displacement transducers, temperature transducers; digital to analog and analog to digital converters; electromechanical instruments; oscilloscopes.

Prerequisite: ELEN310

ELEN210 Electronics I

Band structure, bonding in molecules and solids, energy bands; electrical properties of materials used in electrical engineering, doped semiconductors in thermal equilibrium, charge neutrality, mass action law, recombination and transport mechanisms, Boltzmann relations, derivation of p-n junction, dc and ac characteristics, charge storage effects. The junction field effect transistor (JFET) and metal oxide semiconductor FET, derivation of dc characteristics.

Prerequisite: ELEN200

ELEN220 Complex analysis and discrete math

This course is composed of the topics from discrete mathematics and complex analysis. Discrete math: Propositional logic, their equivalence, proofs, quantifiers and their instantiation, set, function, growth of function, basic algorithm, prime numbers, gcd, relation, counting, basic counting. Complex analysis: Complex Numbers, single and multiple functions, limits and continuity, analytic functions, complex differentiation, Cauchy-Riemann formula, contour integrals, Cauchy›s residue theorem, infinite series Taylors and Laurents series.

Prerequisite: Math101

ELEN224 Probabilistic Methods in Electrical Eng.

Fundamentals of probability theory, continuous and discrete random variables, distribution functions, Gaussian and other distributions, function of random variables, joint and conditional probabilities, moments and statistical averages, introduction to random process.

Prerequisite: ELEN 230

ELEN326 Engineering Programming

Overview of computer hardware and software; Programming in C with emphasis on modular and structured programming technique; Problem solving and algorithm development; numeric 1-D and 2-D arrays, strings and pointers, applications in electrical engineering.

Prerequisite: CSC001

ELEN230 Signals and Systems

Elementary signals and discrete and time continuous signals. Signal and system properties. Discrete and Continuous Convolution. Discrete and Continuous Fourier series. Continuous Fourier transform. Fourier transform properties. Continuous Laplace transform and properties.

Prerequisite: ELEN200, MATH241

ELEN232 Control Systems

Principles of control systems, modeling of physical systems: electrical/mechanical systems, system representations using block diagrams, feedback control system characteristics, performance of feedback control systems, Routh-Hurwitz stability, steady state error, root locus method, PID control, and introduction to frequency response.

Prerequisite: MATH383, ELEN230

ELEN233 Control Systems Lab

This laboratory introduces the students to the practical implementation of modeling and various PID control combinations. In addition, students get to understand the impact of closed-loop control on system performance. Applications include process and DC motor systems.

Prerequisite: ELEN 232, ELEN 203

ELEN240 Electromagnetics I

Review to vector analysis, coordinate systems and transformation; Electrostatic fields; Coulomb›s law and electric field intensity; Gauss›s law and electric flux density; Maxwell›s first equation; Energy, electric potential and potential gradient; Dielectrics and capacitance; Current density and conductors; Charge images; Poisson›s and Laplace's equations; Magnetostatics fields; Bio–Savart and Amperes laws; Curl and Stokes's theorem; Magnetic materials; Self and mutual inductances; Energy in static Fields.

Prerequisite: MATH284, PHYS205

ELEN250 Logic Design

Number systems; Boolean algebra; Logic gates, Boolean functions; Design of combinational logic circuits: comparators, decoders, code conversions, BCD to seven segment decoders; Flip flops; Shift registers; Design of sequential logic circuits; Types of memories; Design of ROMs.

Prerequisite: ELEN200

ELEN250 Logic Design Lab

Design of combinational logic circuits: comparators, decoders, code conversions, BCD to seven segment decoders; Flip flops; Shift registers

Prerequisite: ELEN203, ELEN250

ELEN260 Communication Engineering I

Amplitude modulations, Angle Modulation, Pulse Modulation, Signal spectrum, FDM, Representation of band-pass signals and systems, Signal-to-noise ratio. Noise equivalent bandwidth.

Prerequisite: ELEN224, ELEN230

ELEN310 Electronics II

Derivation of dc and ac terminal characteristics, equivalent circuits, BJT and FET amplifier biasing networks; small-signal equivalent circuits; single and multi-stage small-signal amplifiers; high and low frequency response; negative feedback amplifiers; introduction to large-signal amplifiers. Introduction to MOSFET.

Prerequisite: ELEN202, ELEN210

ELEN311 Electronics Lab

Get the dc and ac terminal characteristics of Silicon Diode LED and Zener, build a half wave and full wave rectification circuits, and design a BJT and FET amplifier biasing networks.

Prerequisite: Pre ELEN203, Pre ELEN210, Co ELEN310

ELEN322 Numerical Methods

Mathematical preliminaries, numerical errors, loss of significance and error propagation. Finite difference method, Numerical solution of nonlinear algebraic equations. Numerical solutions of linear and non-linear algebraic equations. Interpolation and approximation and curve fitting. Numerical differentiation and integration. Numerical solution of differential equations. Eigenvalue problems. Introduction to numerical solution of partial differential equation. Engineering applications.

Prerequisite: MATH241

ELEN330 Digital Signal Processing

Revision of discrete time signals and their properties. Revision of Discrete Time Fourier transform. A/D and D/A conversions. The concept of frequency in continuous and discrete time signals. Z Transform and its applications. Implementation of discrete time systems (FIR, IIR and state-space system analysis). Introduction to digital filters. Discrete Fourier transform and its applications. FFT algorithms.

Prerequisite: ELEN230

ELEN331 Scientific Computing

Introduction to MATLAB. MATLAB Environment. Built-In MATLAB Functions. Using the help feature. Random numbers. Complex numbers. Matrices and vectors. User defined functions. Loops. User controlled input and outputs. Logical functions. Symbolic math and integrals. Plotting in 2D and 3D. Numerical techniques: solve functions, curve fitting, interpolation.

Prerequisite: MATH241, ELEN200

ELEN340 Electromagnetics II

Time varying fields; Faradays law: Transformer and motional emfs; Displacement current; Maxwell›s equations and time harmonic fields; Transmission lines; Standing waves and reflection coefficient; Impedance matching; Wave equation; Power transfer and Pointing vector; Plane wave propagation: in free space, in lossy dielectrics and in good conductors; Reflection of plane wave; Introduction to radiation and antennas.

Prerequisite: MATH383, ELEN240

ELEN341 Electromagnetics Lab

Practical Experiments to demonstrate electromagnetics laws including Coulomb›s law, Ampere›s laws, Faraday›s law, standing waves, impedance matching, wave propagation, antenna measurements.

Prerequisite: Pre ELEN203, Pre ELEN240, Co ELEN340

ELEN352 Embedded Systems

Embedded system design and applications, synthesis of microcontroller systems, including hardware, programming, and interfacing. It also covers microcontroller architecture and peripherals basics, microcontroller parallel interfacing and serial communication, I/O techniques requirements, A/D conversion, timing and interrupts. Principles of instruction set, assembly and high languages programming. In this course, the C compiler is used for programming. The 8-bit PIC microcontroller will be used as well to get the particularization of all theoretical concepts.

Prerequisite: ELEN226, ELEN250

ELEN361 Communications Engineering Lab

This laboratory introduces the students to the practical implementation of communications transceivers for various techniques like DSB, SSB, AM and FM and introduces sampling and multiplexing techniques.

Prerequisite: ELEN260, ELEN 203

ELEN370 Electric Machines

Basic principles of electrical machines and energy conversion, magnetic circuits, principles and operation of single phase and three-phase transformers, principles, operation, key characteristics and applications of three phase induction motors, introduction to DC machines and synchronous generators.

Prerequisite: ELEN 202, ELEN340

ELEN372 Electric Energy Engineering

Power system components: generation, transmission, and distribution; Energy sources: fossil, nuclear, and renewable; Energy conversion; Power calculations; Per- phase analysis; Transformers; Overhead transmission line parameters: resistance, inductance, and capacitance calculations; Overhead transmission line equivalent circuits; Voltage regulation and efficiency of overhead transmission line; Underground cables: construction and types; Power factor correction in three-phase circuits.

Prerequisite: ELEN 370

ELEN373 Electric Machines and Energy Lab

The aim of this course is to introduce the students to three-phase circuits and power measurements, single phase transformer, three-phase transformers, DC machines, parameters of three-phase synchronous generator, three-phase induction motor.

Prerequisite: Pre ELEN203, Pre ELEN370, Co ELEN372

ELEN410 Power Electronics

Single phase controlled and uncontrolled rectifier circuits, three phases controlled and uncontrolled rectifier circuits, Power semiconductor devices, such as: Power Diode, Thyristor, Power BJT, and Power MOSFET, Base drive and firing circuits of power devices.

Prerequisite: ELEN310

ELEN495 Graduation Project I

The goal of graduation projects is to prepare the students to participate in engineering projects related to an appropriate industry. Thus, all project teams are to follow standard industrial practices, methods and processes. Teams must carry the engineering project to completion, examining real world and multiple design constraints, following applicable industrial and business standards. Such constraints may include but are not limited to: economic, environmental, and industrial regulations, time and resource management, and cross-disciplinary/departmental result integration. Students are required to work collaboratively in multidisciplinary teams whenever possible. Graduation Project I is the first of two sequential semesters devoted to a team project that engages students in the full engineering design process. Project proposals will be written, reviewed and approved by advisors. Initial designs will be completed and corresponding constraints will be determined. All students will participate in a public oral and poster presentation following departmental guidelines. Teams are required to submit weekly written progress

reports adhering to established guidelines.

Prerequisite: ENG213, ELEN370, ELEN311

ELEN496 Graduation Project II

Continuation of the Graduation Design project begun in the previous semester. In Graduation Design II, projects based on approved project proposals will be completed. All limitations of the design will be determined and addressed. All students will participate in a public oral presentation following faculty-approved guidelines at a faculty-approved time and location. Teams will also submit a written final report and documented team communication (complete sets of weekly reports and/or log books) following faculty-approved guidelines.

Prerequisite: ELEN495

ELEN399 Summer Training

All students must participate in training program in the electrical engineering field where they are expected to gain practical experience. At the completion of 8 weeks of supervised training each student must submit a formal report and oral presentation. Prerequisite: Successfully passing 120 credit hours

ELEN360 Communications Engineering II

Signal-to-noise ratio and probability of error. Mutual information and entropy. Optimum receivers. Pulse detection and matched filters. Signal distortion in transmission and equalization. Classic digital modulation schemes M-PSK and M-QAM modulations. Baseband-bandpass conversion, Performance evaluation in the presence of additive white Gaussian noise.

Prerequisite: ELEN260

ELEN412 Power Electronics Applications

Review of single phase and three phase controlled and uncontrolled power rectification. DC choppers and voltage regulators such as Buck, Boost, Buck-Boost, and Bulk converters. Switched Mode Power Supplies. AC voltage controllers. DC-AC converters (Inverters). Power electronics for motor drives.

Prerequisite: ELEN410

ELEN432 Industrial Automation

Components and characteristics of industrial processes, process development, integration of components, introduction to process automation, industrial controllers, process automation using PLCs, introduction to computer control and SCADA systems.

Prerequisite: ELEN202, ELEN352

ELEN436 Industrial Motor Control

This course aims to introduce the students to the principles of motor control; motor starting methods, soft starters, sensing and operation of motor control systems, motor protection and safety, motor installation, motor braking methods, types of mechanical loads, variable speed motor controls, sequencing and switching, maintenance, and troubleshooting techniques.

Prerequisite: ELEN310, ELEN370

ELEN440 Antennas

Introduction, antenna characteristics, radiation resistance, gain and directivity, efficiency, beam width and bandwidth, mathematical analysis of antennas, dipole and monopole antennas, ground effect, loop antennas, waveguides and aperture antennas, antenna arrays, beam steering.

Prerequisite: ELEN340

ELEN462 Wireless Communications

Overview of Wireless systems. Cellular Concept. Cell splitting and sectoring. Trucking and queuing Theory. Large Scale fading. Two ray model. Fresnel zones. Okumura and Hata channel models. Small scale fading. Delay spread, coherence time and bandwidth and Doppler spread. Overview of 2G, 3G, OFDM, MIMO and future wireless standards.

Prerequisite: ELEN260

ELEN464 Optical Communications

Introduction to optical waveguides and fibers, propagation characteristics of fibers, characterization methods, LEDs, laser diodes, optical receivers, optical amplifiers, all- optical switching and fiber optic communication systems.

Prerequisite: ELEN260, PHYS205

ELEN466 Satellite Communications

History of satellite communications. Satellite systems: orbits and constellations, satellite space segment, propagation and

satellite links. Satellite communications techniques: modulation and coding techniques, multiple access, on-board processing techniques. Systems and applications: INTELSAT systems, SAT networks, GPS, GEO, MEO and LEO mobile communications,

Prerequisite: ELEN340, ELEN260

ELEN468 Data Networks

OSI and TCP/IP network layers; types of physical channels; data transmission; link layer operation: error control and reliable transmission; circuit and packet switching; local and wide area networks; routing algorithms; IP protocol; operation of TCP and UDP; higher layers and quality of service.

Prerequisite: ELEN260

ELEN470 Power System Operation and Control

Overview of Energy Management Systems (EMS) and their functions; Economic Dispatch; Automatic Generation control; Unit Commitment; State Estimation; Stability; Security. Application: the Saudi Power System.

Prerequisite: ELEN372, ELEN232

ELEN472 Protection of Power Systems

Power System Faults, System Protection Components, Instrument Transformers, Protective Relay Technologies, Overcurrent Relays, Radial System Protection, Reclosers and Fuses, Directional Relays, Protection of Two-Source System with Directional Relays, Zones of Protection, Line Protection with Impedance (Distance) Relays, Differential Relays, Bus Protection with Differential Relays, Transformer Protection with Differential Relays, Buchholz Relay, Surge Arrestors, Pilot Relaying, Digital Relaying. Demos using PSCAD. Prerequisite: ELEN372

ELEN474 Power System Analysis

Generation, transmission, and distribution of power (the voltage levels); Single line representation of power system; Per-unit system; Load flow; Fault calculations; Optimal Load Flow. The Saudi Power Network. Applications: Test Case – the IELENE 30 bus system. Prerequisite: ELEN372

ELEN476 Renewable Energy and Smart Grids

Energy Resources, Energy Conversion, Energy Conservation, Cogeneration of Heat and Power, Fossil Fuel, Carbon Emissions, Basics of Solar energy systems, Photovoltaic Systems, Solar Thermal Systems, Other Renewable Energy Sources (Wind, Bio

Fuel, Geothermal, and Fuel Cells), Electric Energy Storage Systems, Smart Grid Technologies, Smart Grid components, Smart Grid Control, Smart Grids Impacts.

Prerequisite: ELEN372

ELEN478 Special Electric Motors

Introduction to special types of electric machinery with all their internal structure, operations, characteristics, and applications. These types include single phase motors, universal motors, hysteresis motors, reluctance motors, stepper motors, brushless motors, and servo motors. Prerequisite: ELEN370

ELEN480 Fundamentals of Energy Efficiency

The main objective of the course is to provide students with the basic principles of energy efficiency. It presents energy consumption reduction measures in buildings, the industrial sector, and transportation. It also introduces energy efficiency standards, energy policies, and the economics of energy.

Prerequisite: ELEN372

ELEN482 High Voltage Engineering

Electrical breakdown in gases: Streamer-Kanal mechanism, breakdown in non-uniform field and corona. Electrical break-down of liquids, Electrical breakdown of solids, Insulating materials, Factors affecting performance of insulators, Testing of insulators, Destructive and non-destructive insulation tests, dielectric gases. Generation and measurement of high AC, DC and impulse voltages and impulse currents. Testing transformers and series resonant circuits. Impulse voltage generator circuits. Impulse current generator circuits. Sphere and uniform field gaps. Electrostatic, generating and peak voltage measuring voltmeters. Voltage dividers. Measurement of impulse voltages and currents.

Prerequisite: ELEN372

ELENxxx Selected topics in Electrical Engineering

The aim of this course is to introduce the students to recent developments or advancements in Electrical Engineering and related fields.

Prerequisite: ELENxxx