

Electrical Engineering Department

History:

The Electrical Engineering department was established with the Faculty of Engineering at Rabigh branch of King Abdulaziz University, on the 3rd of Rajab 1429 by a Royal Decree (No. 24/49/1429) of the Custodian of the Two Holy Mosques, King Abdullah Bin Abdulaziz, the President of the Council of Higher Education. The Department of Electrical Engineering has three major objectives: providing high quality teaching, participating in relevant community services, and producing a scientific research able to solve the problems of industry.

Department requirements:

In order to qualify for a B.Sc. degree in Electrical Engineering:

- (a) A student must successfully complete 155 credit hours with an overall GPA of 2.75 out of 5 or better while satisfying the curricular requirements of his program of specialization.
- (b) Each student is also required to complete one summer training of 10 weeks in industry under the supervision of a faculty member.
- (c) The typical study period is five years (10 semesters) and the credit hours are distributed as follows:

○ University Requirements	26
○ Faculty Requirements	44
○ Departmental Compulsory Requirements	61
○ Department electives requirements	18
○ Free Courses Requirements (from other Faculties)	6

Compulsory courses:

No.	Course code and number	Course title	credit hours	Communication hours	Distribution of communication hours (lecture, Lab, Exercises)	prerequisite
1.	EEN 100	Electrical Circuits I	3	6	(2,2,2)	PHYS 202
2.	EEN 201	Electrical Circuits II	3	4	(3,0,1)	EEN 100
3.	EEN 202	Electrical Measurements	3	5	(2,2,1)	EEN 201
4.	EEN 210	Electronics I	2	4	(2,0,2)	EEN 100
5.	EEN 211	Electronics Lab.	1	2	(0,2,0)	EEN 100
6.	EEN 212	Digital Logic Design	2	4	(2,0,2)	EEN 210
7.	EEN 213	Digital Logic Design Lab.	1	2	(0,2,0)	EEN 210
8.	EEN 220	Electromagnetic Fields	3	4	(3,0,1)	MATH 203
9.	EEN 271	Engineering Numerical Methods	3	4	(3,0,1)	EEN 170 MATH 204
10.	EEN 303	Signals and Systems	2	4	(2,0,2)	MATH 204
11.	EEN 304	Automatic Control	3	5	(2,2,1)	EEN 201 MATH 204
12.	EEN 305	Probability and Statistic	2	3	(2,0,1)	EEN 303
13.	EEN 314	Electronics II	3	6	(2,2,2)	EEN 210
14.	EEN 330	Fundamentals of Power Systems	3	4	(3,0,1)	EEN 201
15.	EEN 331	Power Systems Lab.	1	2	(0,2,0)	EEN 201
16.	EEN 340	Electrical Machines I	2	4	(2,0,2)	EEN 220
17.	EEN 341	Electrical Machines Lab.	1	2	(0,2,0)	EEN 220
18.	EEN 350	Introduction to Communications	3	4	(3,0,1)	EEN 303
19.	EEN 351	Communications Lab.	1	2	(0,2,0)	EEN 303
20.	EEN 390	Summer Training	2	40	(0,0,40)	Complete 110 CU
21.	EEN 415	Embedded Systems	3	6	(2,3,1)	EEN 212
22.	EEN 498	Senior Project I	1	2	(1,0,1)	Complete 110 CU

23.	EEN 499	Senior Project II	3	6	(1,4,1)	EEN 498
	Total		51	125	(37,25,63)	-

Courses Description:

1- EEN 100: Electrical Circuits

Electric quantities and circuit elements; Kirchhoff's laws; Mesh and node analyses; Sinusoidal steady-state analysis using phasors; Network theorem and transformations. Three-phase circuits.

2- EEN 201: Electrical Circuits II

Magnetically coupled circuits. Transient analysis via the conventional and Laplace methods. Fourier analysis with applications to circuits. Two-port networks.

3- EEN 202: Electrical Measurements

Fundamental Measurement Concepts, Generalized measurement system, errors in measurements, characteristics of measuring instruments statistical analysis of errors. Oscilloscopes, analog AC and DC instruments, measurement of power, DC and AC bridges, transducers, fundamental of electronic instruments, attenuators, converters, peak and average detectors. RMS detectors. digital instruments, digital display units, digital voltmeter.

4- EEN 210: Electronics I

P-N junctions, operation and analysis of semiconductor diodes; diode circuits and applications; Field-effect and Bipolar junction transistors. Low frequency equivalent circuits. Basic amplifiers.

5- EEN 211: Electronics Lab.

Characteristics of semiconductor diodes. Rectification circuits. Clipping and clamping circuits. Characteristics and applications of Zener diode characteristics and applications of BJT. Characteristics and applications of FET.

6- EEN 212: Digital Logic Design

Study the basic principle of representation and manipulation of digital information. Apply the Boolean Algebra and Karnaugh Maps to design the digital circuits. Several digital building blocks such as MUX, Decoder, ROM, and PLA are used for designing complex combination circuits. Sequential circuits such as counters, code converters and shift registers are designed using flip-flops.

7- EEN 213: Digital Logic Design Lab.

Digital Design. It involves simulation using logic simulation tools such as NI-Multisim and hardware realization in the laboratory. Logic simulation and Implementation AND-Gate, OR-Gate, Decoder, MUX, DEMUX, ADDER, counters, Shift registers, Sequential networks.

8- EEN 220: Electromagnetic Fields

Electrostatic fields, Poisson and Laplace equations, Steady electric current, Steady magnetic fields, Time-varying electric and magnetic fields, Maxwell equations.

9- EEN 271: Engineering Numerical Methods

Introduction. Solution of non-linear equations. Solution of large systems of linear equations. Interpolation and curve fitting. Function approximation. Numerical differentiation and integration. Special Functions. Solution of the initial value problem of ordinary differential equations.

10- EEN 303: Signals and Systems

Continuous-Time Signals And Systems, Continuous-Time Linear Time-Invariant Systems, Fourier Series, The Fourier Transform, Applications Of The Fourier Transform, The Laplace Transform, State Variables For Continuous-Time Systems, Discrete-Time Signals And Systems, Discrete-Time Linear Time-Invariant Systems, The Z-Transform, Fourier Transforms Of Discrete-Time Signals

11- EEN 304: Automatic Control

Introduction to control systems with examples from different fields, Transfer functions and block diagram algebra, Stability analysis (Routh-Hurwitz and Nyquist), Design of Control Systems using Bode diagrams and root locus techniques.

12- EEN 305: Probability and Statistic

Frequency distributions –descriptive measures – calculations for central tendency and variability – sample spaces and events – counting – axioms of probability – elementary probability theorems – conditional probability – Bay's theorem – mathematical expectations – discrete random variables – Binomial distribution – hyper geometric distribution – mean and variance of a probability distribution – Chebyshev's theorem – Poisson process– normal distribution – uniform, log-normal, gamma, beta – joint probability densities – populations and samples – sampling distribution of the mean – sampling distribution of the variance

13- EEN 314: Electronics II

Power Amplifier: Class A, Class A Transformer coupled, Class B, Class AB, Class C, and

Class D. Tuned Amplifiers. Amplifier Frequency Response. Negative Feedback Amplifiers, Positive Feedback and Oscillator Circuits. Internal structure of an OP-AMP. Differential Amplifier DC And AC analysis, OP-AMP applications, Multi-vibrators: A stable and Mono-stable applications. Regulated Power Supply. Active Filter circuits

14- EEN 330: Fundamental of Power Systems

Electrical Characteristics and steady state performance of overhead transmission lines. Equivalent Circuit and Power Circle Diagrams. Per-unit Systems and Symmetrical Short-Circuit calculations. Power systems economics. Introduction to Switchgear and Protection.

15- EEN 331: Power Systems Lab.

Transients in ac and dc networks experiments, Magnetism/electromagnetism experiments, Three-phase synchronous machines experiments, Transformer experiments, Transmission line model experiments.

16- EEN 340: Electrical Machines I

Theory and modeling of electromechanical devices. Magnetic circuit. Power transformers. Physical construction and applications of D. C. machines. Qualitative introduction to A.C. Machines.

17- EEN 341: Electrical Machines lab.

No-load test of DC Generator – load test of different types of self excited DC generators - loading test of DC motors- single phase transformer testing.

18- EEN 350: Introduction to Communications

Introduction to communication systems, Analysis of AM, FM and PM transmitters and receivers. AM and FM transmitters and receivers, Detectors, Mixers, Super heterodyne receiver. RF power amplifiers and applications, SSB transmitters and receivers. FM stereo broadcast transmitter and receivers. Sampling Theorem, PAM, TDM.

19- EEN 351: Communications Lab.

AM, FM and PM transmitters and receivers. Detectors, Mixers, Super heterodyne receiver. RF power amplifiers, SSB transmitters and receivers. FM stereo broadcast transmitter and receivers. Sampling Theorem, PAM, TDM.

20- EEN 390: Summer Training

10 weeks of training in industry under the supervision of a faculty member, students have to submit a report about their achievements during training in addition to any other

requirements as assigned by the department.

21- EEN 415: Embedded Systems

Microprocessor architecture and organization. Bus architectures. Data path organization. Memory and I/O subsystems, organization, timing and interfacing. Assembly language instructions, programming and Interrupts.

Compulsory courses outside the department:

Course code and number	Course title	credit hours	Communication hours	Distribution of communication hours (lecture, Lab, Exercises)	prerequisite
MEN 130	Basic Workshop	1	4	(0,3,1)	-
MEN 225	Engineering Mechanics	3	5	(3,0,2)	PHYS 281
CHEN 310	Materials Properties	2	3	(2,0,1)	EEN 210 CHEM 281
MEN 367	Thermo-Fluids	3	4	(3,0,1)	PHYS 281 MATH 202
IEN 481	Intro to Entrepreneurship	1	3	(1,0,2)	IEN 202
Total		10	19	(9,3,7)	

1- MEN 130 Basic Workshop I

Introduction to principles of production, Engineering materials, Measurements, Standards Specifications, Foundry, Metal forming (forging, extrusion, drawing, press work, rolling, wire drawing), Sheet metal work, Welding, metal cutting and machine tools (sawing, drilling, turning, milling, shaping, slotting, grinding), Fitting, Industrial safety, Production management and production planning.

2- MEN 225 Engineering Mechanics

General Principles of Statics; Force Vectors (2D & 3D); Equilibrium of a Particle (2D & 3D); Force System Resultants (2D & 3D); Equilibrium of a Rigid Body (2D); Center of Gravity and centroid of a Body, Mass moment of inertia, Rotation and translation of a rigid body in the plane, General plane motion, Displacement, velocity, and acceleration of rigid bodies, Equations of motion for a rigid body,

3- CHEN 310 Materials Properties

Atomic structures and inter atomic bonding, bonding forces and energies, the structure of Crystalline solids, polymorphism and allotropy, mechanical properties of metals, stress strain behavior, Elastic properties of materials, application and processing of metal alloys, polymer structures, thermoplastic and thermosetting structures, Composites, fiber and matrix phase, hybrid composites, corrosion and degradation of materials, corrosion rates, forms of corrosion, corrosion environment, electrical conductivity and thermal conductivity, Diamagnetism and Paramagnetism, refraction, reflection absorption, ferrous and nonferrous metals , Ferro electricity.

4- MEN 367 Thermo-Fluids

Fundamentals of Thermodynamics, First and Second Laws of Thermodynamics, Various power and refrigeration cycles, Heat transfer modes including steady and unsteady conduction, convection and radiation, Flow statics and buoyancy, Mass, momentum and energy conservation, Bernoulli equations, Internal and external flows.

5- IEN 481 Introduction to Entrepreneurship

Overview of the entrepreneurial process from an engineering perspective. Idea generation, planning, financing, marketing, protecting, staffing, leading, growing, and harvesting. Basic framework for understanding the process of entrepreneurship, principles of management and related techniques in decision making, planning, marketing, and financial control. Exercises in practical ideas about launching own enterprises. Classroom lectures are combined

List of selective courses for Electrical Engineering department: The student selects 6 courses with 18 credit units from the list of elective courses.

No.	Course code and number	Course title	credit hours	hours	Distribution of communication hours (lecture, Lab, Exercises)	prerequisite
1-	EEN 432	High Voltage Engineering	3	5	(2,2,1)	EEN 330
2-	EEN 442	Power Electronics	3	5	(2,2,1)	EEN 314
3-	EEN 443	Electrical Machines II	3	5	(2,2,1)	EEN 340 EEN 341
4-	EEN 433	Protection and Switchgear	3	5	(2,2,1)	EEN 330
5-	EEN 434	Power Systems Analysis	3	4	(3,0,1)	EEN 330
6-	EEN 435	Power Networks Planning	3	4	(3,0,1)	EEN 330
7-	EEN 436	Power System Control	3	4	(3,0,1)	EEN 304 &EEN 330
8-	EEN 437	High Voltage Applications	3	4	(3,0,1)	EEN 432
9-	EEN 438	Special Topics in Power System	3	4	(3,0,1)	-
10-	EEN 444	Electric Drive Systems	3	5	(2,2,1)	EEN 442 &EEN 443
11-	EEN 445	Special Electrical Machines	3	5	(2,2,1)	EEN 443
12-	EEN 446	Programmable Logic Controllers	3	5	(2,2,1)	EEN 212 &EEN 304
13-	EEN 447	Industrial Power Electronics	3	5	(2,2,1)	EEN 442
14-	EEN 448	Electrical Machines Analysis	3	5	(2,2,1)	EEN 271 &EEN 443
15-	EEN 449	Special Topics in Machines	3	4	(3,0,1)	-
16-	EEN 421	Electromagnetic Waves	3	5	(2,2,1)	EEN 220 &EEN 350
17-	EEN 452	Digital Communications	3	5	(2,2,1)	EEN 212 &EEN 350
18-	EEN 460	Computer Networks	3	5	(2,2,1)	EEN 212 &EEN 350

19-	EEN 422	Antennas and waves Propagation	3	5	(2,2,1)	EEN 421
20-	EEN 453	Mobile Communications	3	5	(2,2,1)	EEN 452
21-	EEN 454	Satellite Communications	3	5	(2,2,1)	EEN 421 &EEN 452
22-	EEN 455	Optical Communications	3	5	(2,2,1)	EEN 421 &EEN 452
23-	EEN 456	Digital Signal Processing	3	5	(2,2,1)	EEN 452
24-	EEN 458	Special Topics in Comm. Eng.	3	4	(3,0,1)	-
25-	EEN 457	Information Theory and Coding	3	5	(2,2,1)	EEN 452
26-	EEN 461	Optical Networks	3	4	(3,0,1)	EEN 460
27-	EEN 462	Data Comm. and Networks	3	5	(2,2,1)	EEN 460
28-	EEN 463	Telecommunications Networks	3	5	(2,2,1)	EEN 452
29-	EEN 464	Special Topics in Networks	3	4	(3,0,1)	-
	Total		18		(--,--,--)	

Courses Dec.:

1- EEN 432: High Voltage Engineering

High voltage generation, and transmission electrical breakdown theories in different insulators (gases, liquids, and solids). High voltage testing (impulse generation, and specifications of high voltage laboratories). Different insulators for overhead transmission lines and substations. Single and 3-core cables Electrical stresses cables calculation of different grounding and earthing schemes

2- EEN 442: Power Electronics

Thyristors, theory of operation, methods of turning on, thyristor limitations, commutation methods. Single and three-phase AC voltage controllers for resistive and inductive loads. Single-phase and three-phase AC-DC converters for resistive and large inductive loads. Analysis of DC-DC converters for resistive, large inductive, and general inductive loads. Single-phase to single-phase cyclo-converter, output voltage and frequency control.

3- EEN 443: Electrical Machines II

Poly-phase induction and synchronous machines. Models and performance characteristics for steady-state operations. Fractional horsepower machines, their performance and application.

4- EEN 433: Protection and Switchgear

Switch gear, busbar systems, couplers, cubicles, auxiliaries, and single line diagram. Relays, electromagnetic, static, thermal relay, and over current, voltage. Distance relays. Differential relays. Feeder protection system. Transformer protection system. Generator protection system.

5- EEN 434: Power Systems Analysis

Load Flow Analysis, Solution of Load Flow Equations, Gauss-Seidel and Newton Raphson Techniques, Asymmetrical Faults, Phase Sequence Networks, Use of Matrix Methods. Power System Stability: Steady-State and Transient.

6- EEN 435: Power Networks Planning

Load forecasting, Load demand management, Load curves and load characteristics, Bulk power system planning, Distribution network planning, Financial and regulatory analysis, Electricity tariff, Power networks reliability studies

7- EEN 436: Power System Control

Analysis and characterization of electric Power Quality, Shunt and series compensation of various power quality events, Power system control: Frequency control of power systems, Voltage control of power systems for single area and multi-area systems, Operational concepts of an electricity power systems in a competitive environment, Transmission access fees assessment and calculations

8- EEN 437: High Voltage Applications

Phenomenon of over-voltages in power systems, Theory of traveling waves and standing waves, Electrostatic field of extra-high-voltage (EHV) lines, Lightning and lightning protection, Over-voltages in EHV systems caused by switching operations, Insulation characteristics of long air gaps, Power-frequency voltage control and over-voltages, EHV testing and laboratory equipment, Design of EHV lines, Design examples.

9- EEN 438: Special Topics in Power System

In-depth study of Electrical Power Systems topics not covered in other courses of the program in order to enhance students' knowledge in the field of Electrical Power Systems.

10- EEN 444: Electric Drive Systems

Elements of electric drive systems, speed-torque characteristics of electric motors and mechanical loads, 4-quadrant operation, dynamics of electrical drives, traction drives, selection of motor power rating, DC motor drives, induction motor drives, synchronous motor drives.

11- EEN 445: Special Electrical Machines

Single phase induction motor, Switched Reluctance motors, Stepper motors, Permanent magnet motors, Linear Motors, Synchronous Reluctance Motors. Models and performance characteristics for steady-state operations. their performance and application.

12- EEN 446: Programmable logic controllers

Relays, ladder logic diagram, programming using PLC, timers, counters, sequencers, applications of PLC in industry.

13- EEN 447: Industrial Power Electronics

Single and three-phase AC voltage controllers for resistive and inductive loads. Analysis of DC-DC converters for resistive, large inductive, and general inductive loads. Single-phase and three-phase inverters for different loads. Buck and boost DC/DC converters, pulse width modulation (PWM) techniques.

14- EEN 448: Electrical Machines Analysis

Basic principles of electrical machines analysis, dynamic analysis of a separately excited DC machines, reference-frame theory, dynamic analysis of three phase induction machines, dynamic analysis of synchronous machines, linearized equations of induction machines and synchronous machines.

15- EEN 449: Special Topics in Machines

In-depth study of Electrical Machines topics not covered in other courses of the program in order to enhance students' knowledge in the field of Electrical Machines.

16- EEN 421: Electromagnetic Waves

Electromagnetic Theory. Plan waves, Maxwell's equations, boundary conditions, Pointing theorem, Wave equation, Plane waves. Transmission lines: Distributed circuit parameters, HF transmission lines, reflections, standing waves. T.L. measurements. Wave guides: TEM, TM and TE transmission, parallel plates waveguides- TE and TM modes. Cavity resonators. Impedance Transformation and Matching. Smith Chart.

17- EEN 452: Digital Communications

Sampling theory, pulse amplitude modulation, time division multiplexing. Pulse code modulation, TDM/PCM, Digital multiplexers. Random Processes, power spectral density, narrow band representation. Noise effect on continuous wave modulation. Base band transmission, matched filter, line codes, and equalizers. M-ary signaling, Eye diagram. Signal Space Analysis, pass band data transmission: PSK, FSK, MSK and QAM. Multi carrier systems, OFDM

18- EEN 460: Computer Networks

Components of data communication systems. Error detection techniques. Network Protocols including the Open System Inter-connection model. Communication carrier facilities. System planning considerations.

19- EEN 422: Antennas and waves Propagation

Radiation and Antenna Fundamentals. Linear Antennas, Current distribution, Short dipoles And Monopoles/2 dipoles, radiation resistance and gain, longer dipoles, folded dipoles. Antenna Arrays. Aperture Antennas. Special types of antennas. Traveling wave antennas, loop antennas. Frequency independent antennas, helical Antennas, corner reflector, lenses. Space Wave Propagation. Ground Wave Propagation. Tropospheric waves. Ionospheric waves.

20- EEN 453: Mobile Communications

Basic Concepts of Mobile Communications. Cell Site Planning. RF Propagation Characteristics. Frequency Planning. GSM Cellular System: features, multiple access techniques, GSM architecture. CDMA(IS 95) System: Spread spectrum systems, Direct sequence SSS, CDMA air links, the forward channel, the reverse channel, diversity receivers. Third Generation Mobile Communication.

21- EEN 454: Satellite Communications

Overview of satellite systems. Orbits and launching methods. Communication satellite subsystems. Modulation schemes and satellite multiple access (FDMA, TDMA, CDMA, and SDMA). Space link analysis. Satellite antennas. Applications of satellites.

22- EEN 455: Optical Communications

Optical fiber waveguides: ray and mode theories. Step-index and graded-index fibers. Transmission characteristics of optical fibers; losses and dispersion. Methods of manufacture of optical fibers and cables. Connection of optical fibers. Measurements of attenuation, dispersion, refractive index profile, numerical aperture, diameter and field. Optical sources, the semiconductor laser and the light emitting diode. Optical detectors. Optical fiber system. Digital and analog systems. Design of a simple optical

fiber communication link

23- EEN 456: Digital Signal Processing

Classification of signals and their mathematical representation. Discrete-time systems classification. Linear shift invariant system response, difference equations, convolution sum, and frequency response. Discrete Fourier transform. Z-transform and its application to system analysis. Realization forms. Sampling and aliasing. Finite-impulse response (FIR). Design windowing technique. Introduction to infinite impulse response (IIR). Filter design techniques.

24- EEN 458: Special Topics in Comm. Eng.

In-depth study of communications engineering topics not covered in other courses of the program in order to enhance students' knowledge in the field of communications engineering.

25- EEN 457: Information Theory and Coding

Concept of information and its measurement. Entropy source coding theorem. Huffman codes, LZW, arithmetic codes. Introduction to rate distortion theory. Channel coding theorem, channel capacity. Block codes: detection and correction. Linear codes, cyclic codes, hamming codes, BCH codes, encoding, and decoding algorithms. Introduction to convolutional codes.

26- EEN 461: Optical Networks

Introduction to optical networking. Time-Division Multiplexing (TDM). Fiber-optic technologies. Wavelength-Division Multiplexing (WDM). SONET architectures. SDH architectures. Packet ring technologies. Optical network case studies.

27- EEN 462: Data Comm. and Networks

Introduction to computer networks: Network topologies; Network architecture and the OSI reference model; Data Link Control: flow control and error control, ARQ Stop/wait , Sliding window protocols, DLC standards : HDLC , PPP and SLIP; Medium Access control Protocols and standards; ALOHA, CSMA, CSMA/CD, Token Ring , Wireless; LAN standards & Devices: Ethernet and IEEE standards for LANs; LAN devices: Bridges, HUBs, Ethernet Switches; Network Layer Services: Datagram and Virtual Circuits; WAN Standards and techniques: X.25, Frame relay, ATM.