Course Structure & Module Handbook

Bachelor Electronics & Communications Engineering

Electronics & Communications Engineering Dept.

Faculty of Mechanical & Electrical Engineering, Tishreen University

Version: September, 2020

Syrian Arab Republic
Tishreen University
Faculty of Mechanical and Electrical Engineering
Communication and Electronic Dpt
Lattakia - Syria

الجمهورية العربية السورية
جامعة تشرين
كلية الهندسة الميكانيكية والكهربائية
قسم هندسة الاتصالات والإلكترونيات
اللاذقية – سوريا

1. Course plan for the department of Communications & Electronics Engineering.

1st Year 1st Semester				
Subject No.	Subject Name	Number of Hours		
		Theory	Laboratory	Total
1	Algorithms & problem solving skills	2	2	4
2	Mathematics 1	4	0	4
3	General physics for engineers	4	0	4
4	IT & internet	4	0	4
5	Arabic language	2	0	2
6	English Language 1	2	0	2
7	Environment protection	2	0	2
Total Hours				22

1st Year 2nd Semester				
Subject No.	Subject Name	Number of Hours		
		Theory	Laboratory	Total
1	Programming	2	2	4
2	Electrical engineering principles	4	2	6
3	Mechanical engineering principles	4	0	4
4	Mathematics 2	4	0	4
5	English Language 2	2	0	2
6	Culture	2	0	2
7	Public health	2	0	2
Total Hours				24

2nd Year

Syrian Arab Republic
Tishreen University
Faculty of Mechanical and Electrical Engineering
Communication and Electronic Dpt
Lattakia - Syria

الجمهورية العربية السورية
جامعة تشرين
كلية الهندسة الميكانيكية والكهربائية
قسم هندسة الاتصالات والإلكترونيات
اللاذقية – سوريا

1st Semester				
Subject No.	Subject Name	Number of Hours		
		Theory	Laboratory	Total
1	Object Oriented Programming (OOP)	2	2	4
2	Mathematics 3	4	0	4
3	Electrical circuits principles	4	2	6
4	Electronic Engineering Principles	4	2	6
5	Web Pages Design	2	0	2
6	Infrastructure & Energy Sources	2	0	2
7	Technical English	2	0	2
Total Hours				26

2nd Year 2nd Semester				
Subject No.	Subject Name	Number of Hours		
		Theory	Laboratory	Total
1	Analog Communications	4	2	6
2	Signals & Systems	4	0	4
3	Technical workshops	0	2	2
4	Electronic Amplifiers	2	2	4
5	Electromagnetic wave propagation & compatibility	4	0	4
6	Mathematics 4	4	0	4
7	Engineering Economics Introduction	2	0	2
8	English 4	2	0	2
Total Hours				28

3rd Year

1st Semester				
Subject No.	Subject Name	Number of Hours		
		Theory	Laboratory	Total
1	Digital & Combinational Logic Circuits	2	2	4
2	Probability Theory & Stochastics	4	0	4
3	Linear & Non-linear Electronic Circuits	4	2	6
4	Digital Communications	4	2	6
5	Advanced Signal Processing	4	2	6
6	Measurement & Measuring Devices	2	2	4
7	Computer Architecture	2	2	4
Total Hours				34

3rd Year 2nd Semester				
Subject No.	Subject Name	Number of Hours		
		Theory	Laboratory	Total
1	Data Transmission	4	0	4
2	Microwave Engineering	4	2	6
3	Computer Aided Design (CAD)	2	2	4
4	Integrated Circuits	4	0	4
5	Microprocessors & Microcontrollers	4	2	6
6	Control Theory	2	2	4
7	Information & Coding Theory	2	2	4
Total Hours				32

4th Year 1st Semester				
Subject No.	Subject Name	Number of Hours		
		Theory	Laboratory	Total
1	Systems & Circuits Modelling	2	2	4
2	Television Systems	4	2	6
3	Radar & Sonar Engineering	4	2	6
4	Landline Telephone Communications	4	2	6
5	Antennas	4	2	6
6	Computer Networks	4	0	4
Total Hours				32

4th Year 2nd Semester				
Subject No.	Subject Name	Number of Hours		
		Theory	Laboratory	Total
1	Optical Communications	4	2	6
2	Cellular & Mobile Communications	4	2	6
3	Digital Image & Audio Processing	4	2	6
4	Ultrasonic Waves Applications	4	0	4
5	Network Protocols	4	0	4
6	Internet Technologies	2	0	2
7	Field Training	0	4	4
Total Hours				32

5th Year 1st Semester				
Subject No.	Subject Name	Number of Hours		
		Theory	Laboratory	Total
1	Network Design and Planning	2	2	4
2	Advanced Mobile Communications	4	2	6
3	Networks Laboratory	0	4	4
4	Software Applications in Communications	2	4	6
5	Nano-Technologies	2	0	2
6	Network Security	2	0	2
7	Graduation Project	2	4	6
Total Hours				30

5th Year 2nd Semester				
Subject No.	Subject Name	Number of Hours		
		Theory	Laboratory	Total
1	Microwave Circuits	2	2	4
2	Satellite Communications	4	0	4
3	Wireless Sensor Networks (WSN)	4	2	6
4	Reliability & Calibration	2	0	2
5	Programming and Managing Networks	2	0	2
6	Artificial Intelligence (AI)	2	0	2
7	Graduation Project	2	4	6
Total Hours				26

2. Curriculum Module Description of Communications & Electronics Engineering Department

Algorithms & Problem Solving Skills	Learning objectives:
	• Provide the student with the needed skill set for solving various engineering problems and enhance her ability to do so
	This is done through:
	• Introducing the algorithmic concepts and principles
	• Designing algorithms and analyzing their performance
	• Introducing the theoretical principles of basic programming concepts such as:
	  ○ Variables
	  ○ Control structures
	  ○ Data structures
	  ○ Functions
	  ○ Arrays
	  ○ Searching and Sorting
	  ○ Lists
	  ○ Testing

Mathematics 1	This module covers the following: • Real and complex number groups and their operations • The study of sequences and their types (numerical and geometric) • Operations on sequences and their limits • Finite and infinite series and their types: (basic, hybrid, series of function) • Series operations and convergence tests • Revise one-variable function study, finite and infinite limits (near a particular input), continuity, derivability, their features and applications. • Taylor, Maclaurin, and binomial series. • Function applications, max and min values, indeterminate cases. • Polynomials definition, principles, operations, and their mathematical analysis. • integrable functions • indefinite integration and ways of finding it • Definite integration for one-variable function and ways of calculating it • Definite integration types and its engineering and geometric applications • Euler (binomial) transform
General Physics	This module discusses the following:

for Engineers	• Matter physics and energy levels (fundamentals in matter structure, atomic structure, and the classification of materials' conductivity depending on their atomic structure)
	• Energy transfer and transformation
	• Light and Laser principles and applications (fundamentals of light, its nature, theories that study and explain the illuminating nature of light, light phenomena: reflection, refraction, etc...)
	• Study of mechanical stress
	• Acoustic principles and the study of longitudinal and transverse waves and their applications.
	• Sound propagation in different media
	• Acoustic pressure
	• Echo and Doppler phenomena
	• Mechanical oscillations
	• Vector analysis:
	  ○ Gradient
	  ○ Divergence
	  ○ Curl
	  ○ Product rules
	  ○ Second derivatives
	• The fundamentals and concepts of electrostatics and electromagnetics
	• Semiconductor physics:
	  ○ Doping
	  ○ Thermal conductivity of semiconductors compared to metals
	  ○ Diodes and their static resistance.
	• Hall effect

Information Technology (IT) & Internet	Learning Objectives: Provide the student with the following: • Structural knowledge overview of Information Technology (IT), communications, data transmission • Ways of accessing data and information websites • Usage of techniques that enable making use of data • Computer network concept • Internet and its structure, mechanism, ways of access, and making the most of it • Practical applications using windows, MS Office (word processor, spreadsheets, presentation) • Making use of internet and information networks for academic research and learning purposes. • Information Technology hardware and software components • An introduction of E-Commerce

	• Data representation • Data sources and encryption • Computer ethics • Confidentiality and privacy • Electronic data exchange • Digital marketing and publishing • Mass media: its principles, concepts, and laws.

Arabic Language	Learning Objectives:
	• Improving student's expressing abilities
	• Encouraging him to use the Modern Standard Arabic (Al-Fusha) as a tool of expression in both writing and speaking
	• Focusing on the following skills:
	  ○ Writing Skills
	  ○ Grammar Skills
	  ○ Functional performance skills (Reading and expressing)
	This is done through: studying a number of selected literature passages and analyzing their grammatical and linguistic structures and demonstrating their aesthetic forms and meanings.

English Language 1	Learning Objectives: • Training on listening, reading, and writing skills on the level of paragraphs and short passages. • Revising basic principles about grammar and vocabulary This is done through working on selected passages and excerpts in various aspects to cover different specializations
Environment protection	Learning Objectives: • Introduce the basic principles of Ecology which was fundamentally defined in the 2nd half of the 20th century This is done by discussing the following: • Natural environment risks • Ecological Systems • Biogeochemical cycles • Human-Nature interaction • Human and natural resources and its harnessing problems • Clean energy • Environment management • Environment protection • Environment diversity and Tourism • Water processing and wastewater • Environmental planning • Regional environment issues • Municipal solid waste and its management

	• Environmental education
Programming	Learning objectives: • Provide the student with the practical skills in relation to "Algorithms & Problem Solving Skills" module. This is done through making the student able to program in a specific language (C++) and to implement the aforementioned concepts (variables, control and data structures, functions, searching and sorting, linked lists, testing).
Electrical Engineering Principles	Learning Objectives: Provide the student with the following: • Electrical Engineering concepts • Electrical components • MKS system of units • Electrical components' symbols, functions, and how to write and draw them • How to represent physical quantities of components • ε_0, μ_0 values and concepts • Direct Current (DC) circuits • Basic concepts of electric current • Matter structure • Charge carriers, free electrons, electron holes, ions, electric charge, electric current, electric voltage, electric conductivity, electric resistance, resistance temperature coefficient, electrical energy, electrical power, Kirchhoff's Laws (Kirchhoff's Voltage Law (KVL), Kirchhoff's Current Law (KCL))
Mechanical Engineering Principles	Learning objectives: Supply the non mechanical majors' students with the necessary and fundamental concepts in thermodynamics and heat transfer. This is done by covering the following: • Basic definitions and concepts in thermodynamics science • Thermodynamics first law • Thermodynamics first law in ideal gases • Thermodynamics second law • Ideal gas law • Cooling device circuitry • Heat pumps • Heat transfer methods • Thermal conduction • Thermal load • Thermal emission

	• An introduction to fluid mechanics
Mathematics 2	This module covers everything related to complex analysis and functions. Including functions' limits, continuities, derivability, integrals, and operations. It also includes calculating their poles and zeroes and residue theorem. It also covers functions of multiple variables, their limits (towards a point or towards infinity), their continuities, their derivability, their features and their applications. Furthermore, the module covers the max and min values of multivariable functions and their approximation into series. Next, it discusses multiple integrals (double and triple), their calculation, and their engineering applications. Then, it studies the improper integrals and integration by substitution.
English Language 2	Building on the previous module this one focuses on more working on the aforementioned skills with more interest on types of details and rhetoric. The used training material varies to adapt with the different academic specializations such as: Computing, Business management, Pharmacy, Law, and every other available program in the university. Trying, as much as possible, to avoid old-fashioned grammatical and structural teaching. Culture: This module is defined according to university's board on an annual basis.
Culture	According the admitted description of university council

Public Health	Learning Objective:
	To educate university students about various health related topics.
	Content:
	• Pubic health
	• Disease and contagion definitions
	• Preventive medicine
	• Regional and communicable diseases
	• Providing information about diseases of civilization (cancer, diabetes, etc...) in addition to AIDS
	• Epidemiology and its types.
	• Helping the students to know more about environmental health indicators:
	  ○ Air quality.
	  ○ Recreational water.
	  ○ Drinking-water quality.
	  ○ Indoor environment.
	• Nutrition health:
	  ○ Nutrients
	  ○ Metabolism
	  ○ Caloric value of various entities of food
	  ○ Complete nutrient food recipes

	○ Poor nutrition and food poisoning • Career/Health issues and career related disorders • TV, Computer, and consoles light exposure • High energy radiation and exposure in hospitals • Common used medications and their misuse including painkillers, antibiotics, tranquillizers, stimulants, and illegal drugs • First aid fundamentals (cuts, bone breaks, bleedings, burns, fainting, heat strokes, poisonous stings: scorpions or snakes)
Object Oriented Programming (OOP)	This module focuses on the comprehension of the concept and its developments. This module intends to complement prior related modules and includes: • An introduction to Java applications • An introduction to classes and objects in Java • Control structures • Methods • Arrays • An extensive dive into classes and objects • Inheritance • Polymorphism • GUI Components • Using the language to link the software to a database • The use of OOP in communications engineering
Mathematics 3	This module covers the following: • Algorithms and numerical methods of finding definite, and indefinite, integrals and differentials. • Numerical solutions of linear systems • Banach fixed-point theorem • Principles and applications of fixed point, repetition, and non-linear equations • Mathematical induction and interpolation • Numerical methods of solving differential equations • 1^{st} order differential equations, their types, and solving methods • Higher order differential equations, their types, and solving methods • Partial differential equations, their types, and solving methods • Simultaneous linear, and non-linear, higher order differential equations
Electrical Circuits Principles	Covers the following topics: • Basic concepts of DC and AC circuits • Electrical circuit analysis • Thevenin, Norton, and superposition theorems • Electrical resonance circuits (series and parallel)

	• Power analysis (apparent, active, and reactive) • Power triangle • Magnetically coupled circuits • Transient modes in circuits • Frequency response • Bode plots • 3 phase circuits including: 3 phase balanced loads, 3 phase transformers, and 3 phase generators. • Laplace transform applications in circuit analysis • Two port networks • Impedance, admittance, transform, and the relationships between parameters
Electronic Engineering Principles	This module provides the most important and fundamental information about semiconductor electronic components starting from the diodes all the way to 4 and 5 pin components. Also it discusses: • The structure of semi-conductive materials and doping in order to get: diodes, BJTs, and FETs. • The analysis and usage of the aforementioned components • The study, analysis, and finding equivalences of practical circuits that make use of diodes and transistors.
Web Pages Design	An introduction about the following: • Historic background about internet. • IP Addresses • Domain names • World wide web • Web browsers • Web servers • XHTML syntax, document structure • HTML basics • Common Language Runtime (CLR) • Cascading Style Sheets (CSS) • .NET framework • ASP.NET fundamentals • ASP.NET Documentation
Infrastructure & Energy Sources	This module covers the structure of electrical power systems based on their different voltage levels and their connection method. Also, it introduces the types of electrical equipment in power stations. Then it discusses the technical study of electrical supply systems of buildings and industrial facilities. Furthermore, it discusses the general principles of lighting science and its applications

Technical English	Learning objectives: • Introducing the terminologies of different technologies. This is done through: • Covering a wide range of the used language in engineering. • Providing the needed skills in order to enable the student to express herself in the scientific subjects that are related to engineering specialties reading, writing, speaking, presenting, and summarizing wise. This module also includes general passages related to the mechanical and electrical engineering branches including: Computing, Control, Information and communication technologies, and marine engineering.

Analog Communications	This module discusses the essential topics in analog communications as it covers the following:
	• An introduction to communication systems
	• Noise and its types (internal and external)
	• Noise calculations
	• Signal to Noise Ratio (SNR)
	• Amplitude Modulation (AM) and its sideband techniques such as:
	  ○ Suppressed Carrier
	  ○ Single sideband
	• Frequency Modulation (FM)
	• Radio receivers such as:
	  ○ AM Receivers
	  ○ FM Receivers
	  ○ Single sideband receivers
	  ○ Independent sideband receivers
	• Transmission lines

Signals & Systems	This module is to study signals, systems, and their classifications. It covers the following:
	• Linear Time-Invariant (LTI) system analysis
	• Signals and systems analysis in frequency domain such as:
	  ○ Fourier transform and its applications
	  ○ Fourier transform for basic signal functions and their applications
	• Correlation functions and Fourier transform
	• Discrete signals in time and frequency domains (Fourier series)
	• Signal sampling and quantization
	• Using block diagrams to represent digital systems.
	• Discrete time systems and signals classification
	• Z-Transform and its applications in LTI system analysis

	• Frequency analysis for discrete time signals • Discrete Fourier Transform (DFT) • Fast Fourier Transform (FFT) • Design and analysis of discrete time systems in frequency domain • Inverse systems • Convolution and deconvolution • Filtering systems • Discrete time systems implementation
Technical Workshops	This module familiarize the students with • Basic electrical and electronic components: resistors, capacitors, inductors, relays, diodes, transistors, ICs, voltage regulators, transformers, and their types. • Industrial control components: Thyristors, triacs, diacs, etc... It also educate the students to handle and use the basic measuring devices: Multimeters and their different types, oscilloscopes, and signal generators. In addition, the students learn to • Measure, and test, the aforementioned components • Identify their functions and practical applications • Handling and reading datasheets of various ICs and transistors.

Electronic Amplifiers	This module covers the following:
	• An introduction to amplification theory using Black box method
	• dBm Concept
	• Amplifiers classification according to signal parameters using radio transmitters and receivers as examples
	• Audio power amplifiers such as:
	  ○ Class A power Amplifiers
	  ○ Transformer coupled power amplifiers
	  ○ Push-Pull amplifiers
	  ○ Class D power amplifiers
	• Small signal amplifiers
	• Low-frequency (and high-frequency) response of BJT & FET amplifiers
	• Tuned amplifier circuits such as single tuned amplifier
	• Cascade amplifier tuned on a specified frequency
	• Operational Amplifiers (Op-Amps) with single and double signal sources
	• Ideal Op-Amp
	• Differential amplifier
	• Multistage amplifiers

Electromagnetic Wave	This module covers the topics related to electromagnetic compatibility and wave propagation as follows:

Propagation & Compatibility	• Magnetic field fundamentals • Theoretic principles of radio wave propagation • Wave propagation in different media (lossy and lossless media) • Wave propagation in water • Wave propagation in case of unbounded homogeneous media • Electromagnetic compatibility and interference caused by electrical devices and circuits and also electromagnetic emissions
Mathematics 4	This module covers the following: • Definitions and fundamentals of matrices • Basic operations on matrices • Matrix inversion and determinate • Simultaneous equations solving using matrices (gaussian elimination and Newton-Raphson methods) • Vector spaces • Eigenvalues and eigenvectors of matrices • Linear transformations and matrices • Euclidean vector spaces • orthogonal and orthonormal matrices • Boolean algebra and its basic operations • Numeral systems and converting numbers. • Prime numbers theory and its applications in numeral systems • Linear methods for optimization problems, problem description, and plot solutions. • Algebraic methods for optimization problems • Problem solving in linear and non-linear programming • Enhancing students' mathematical problem solving • Graph theory, representation methods, engineering applications, and graph functions.
Engineering Economics Introduction	This module introduces: • Economics field and its relations to other sciences and to the economic issues. • Supply and demand theories • Supply and demand components and their importance • Utility Theory • Production function • Costs function • Analyzing commodity markets in competition and monopoly cases • Supply and demand of production components in the market structure • Gross National Production (GNP) Calculations and analyzing the level of total economic variables such as income, investment, saving, price levels, employment and their relations to each other in the final

	model and the role of the government and its financial policies in the: ○ Total balance of the economy. ○ Distribution of the national income among the production entities • Principles of money, Banks, and monetary policy • International trade and balance of payments
English Language 4	Learning objectives: • More skills development that was focused on in the prior English module This is done through: • Technical and academic ways of language use in the technological engineering domain. • Scientific-research-specific language The main theme of this module is Electronics & Communications Engineering (ECE).
Digital & Combinational Logic Circuits	This module covers the following: • Coding, and numeral systems reminder • Boolean algebra • Digital circuits • Digital gates • Max and Min terms notation • Representation and simplification of Boolean functions on Karnaugh map • Adders, multiplexers, and hazards in digital and combinational logic circuits • Flip-flops • Bistable multivibrator: ○ Synchronous: using NOR and NAND digital gates ○ Synchronous R-S type ○ Asynchronous: using P-MOS technology ○ Etc... • Registers, Counters, and their different types • Design clocking circuitry using combinational logic circuits.
Probability Theory & Stochastics	This module covers the basic topics of probability theory in communications including: • Random variables • Continuous probability distribution • Discrete probability distribution • Random vectors • Joint probability distribution

	• Joint probability density function
	• Continuous and discrete marginal probability distribution
	• Conditional probability distribution
	• Expected value and conditional expectation
	• Standard deviation
	• Probability distributions:
	  ○ Binomial distributions
	  ○ Poisson distribution
	  ○ normal distribution
	  ○ geometric distribution
	  ○ Pascal, Hypergeometric, Beta, gamma, Maxwell–Boltzmann, Exponential distributions
	• Statistics, measures of central tendency, statistical dispersion, and frequency distribution.

Linear & Non-Linear Electronic Circuits	This module includes:
	• Circuits classification
	• Filtering circuits such as:
	  ○ Ideal filters
	  ○ Basic filters
	  ○ K-Factor filters
	  ○ M-Factor filters
	  ○ Active filters
	• Sinusoidal oscillators such as:
	  ○ R-C Feedback Oscillators such as Phase-shift oscillators
	  ○ L-C Feedback Oscillators
	  ○ Crystal-Controlled Oscillators
	  ○ Negative resistance Oscillators
	  ○ Voltage controlled Oscillators
	  ○ Oscillators using Op-Amps
	• Deferential and Integral circuits
	• Attenuation Circuits
	• Phase correction circuits
	• Amplitude Clipping circuits
	• Clamping circuits
	• Switching circuits
	• Pulse circuits
	  ○ Bistable multivibrator (symmetrical and asymmetrical triggering)
	  ○ Schmitt trigger
	  ○ Pulse circuits using Op-Amps
	  ○ Timer circuits

Digital	This module covers the topics of Digital communications as follows:

Communications	• Analog pulse modulation such as:
	  ○ Pulse Amplitude Modulation (PAM)
	  ○ Pulse Duration Modulation (PDM)
	  ○ Pulse Phase Modulation (PPM)
	• Digital pulse modulation such as:
	  ○ Pulse-Code Modulation (PCM)
	  ○ Differential Pulse-Code Modulation (DPCM)
	  ○ Delta Modulation (DM)
	  ○ Adaptive Delta Modulation (ADM)
	• Digital Band-Pass Modulation Techniques such as:
	  ○ Amplitude-Shift Keying (ASK)
	  ○ Frequency-Shift Keying (FSK)
	  ○ Phase-Shift Keying (PSK)
	  ○ Quadrature Amplitude Modulation (QAM)
	• Multiplexing such as:
	  ○ Frequency-Division Multiplexing (FDM)
	  ○ Time-Division Multiplexing (TDM)
	• Spread spectrum modulation such as: frequency hopping spread spectrum modulation

Advanced Signal Processing	This module covers the latest updates and topics of signal processing and random signals whereas it discusses: • Adaptive filters • Constant models and operations • Spectrum analysis • Power Spectral Density's Characteristics (PSD) • Electrical density estimation • Eigen analysis • Eigen filters • Wiener filters • Wiener-Hopf equations • Forward and Backward linear predictions • Levinson-Durbin algorithm • Network prediction • Inverse filtering using network prediction • Kalman filters: structures, functions, and applications • Innovation • Innovation-based state estimation
Measurements & Measuring Devices	This module covers the topics related to measurements and errors as follows: • Precision, sensitivity, and tuning • Measurement error types • Decibel concepts • Measurement symbolic notations

	• Electro-Mechanical measurement devices:
	  ○ Analog Ohmmeter
	  ○ Loading effect
	  ○ Voltmeter
	  ○ Wattmeter
	  ○ Frequency meter
	  ○ kVar meter
	• Electronic devices:
	  ○ Electronic measurement devices
	  ○ Analog to Digital Converters (ADC)
	  ○ Digital to Analog Converters (DAC)
	• Oscilloscope and Cathode-Ray Tube (CRT)

Computer Architecture	This module aims to generally study: • Computer architecture and its fundamental components • Instruction set and instruction set architecture • Computer performance assessment and assessment methodologies • Central Processing Unit (CPU) design and structure • Basic arithmetic and logical operations in computers • Memory and memory hierarchy • I/O coordination • Multi-processors
Data Transmission	This module discusses introductions and definitions of data transmission such as: • Structure of distribution systems • Data transmission end devices • Data communication devices • The use of transmitter systems and switching management as in X.25 Packet switching standard • Message switching techniques as in circuit switching and packet switching • ISDN • Communication technologies • Transmitting hindrances • Digital transmission of digital data • Baseband pulsed transmission • Transmission media and its two types (guided and unguided)
Microwave Engineering	This module covers the following: • An introduction to electromagnetic microwaves • Microwaves spectrum and their theoretical fundamentals • Equivalent impedance transforms

	• Smith chart • Electromagnetic microwaves propagation • Ferrite medium • Electromagnetic microwaves applications as in medical biology • Microwave cavities • Two port networks • Basic microwave elements • S parameters • Signal-flow graph • Microwave filters • Magnetrons, Klystrons, Travelling Wave Tubes (TWTs), and Gyrotrons
Computer Aided Design (CAD)	This module covers: • Computer Aided Design (CAD) tools for analog circuits • Analog circuits' simulation experiments such as: amplifiers, filters, oscillators, etc... • Analog circuits' simulation pieces of software (PSPICE) • Electrical and electronic components modelling (diodes, BJTs, FETs, Op-Amps, and other components).

Integrated Circuits	This module covers semiconductors technology, Integrated Circuits (ICs), and basic operations in Surface-Mound technology (SMDs). This includes:
	• Bipolar integrated circuit technologies such as:
	  ○ Polarity protection using reverse bias diode
	  ○ Vertical NPN bipolar transistor
	  ○ Horizontal PNP bipolar transistor
	  ○ Multi-Collector integrated transistors
	  ○ Darlington transistor configuration
	  ○ High current source integrated transistors
	• Field Integrated Circuits (unipolar) such as:
	  ○ J-FET
	  ○ MOSFET
	  ○ Dual gate MOSFET
	  ○ Impact Ionization MOS transistor (IMOS)
	  ○ Etc...
	• Integrated Circuits design stages
	• Analog IC design concepts of:
	  ○ Voltage regulators (723 IC)
	  ○ IC Timers (555 IC Timer)
	  ○ Analog multipliers (AD534)
	• Digital IC design concepts of logic gate families such as:
	  ○ DCTL
	  ○ RTL
	  ○ TTL

	○ MOS based logic gates and output stages of MOSFET based logic gates ○ CMOS • VLSI ICs • MOS Dynamic Memory Cells • Static and dynamic characteristics of combinational logic circuits
Microprocessors & Microcontrollers	This module is for students who acquired the necessary knowledge in computer architecture and continue to make use of this knowledge in various applications (communications, control, measurement, etc...). The module basically covers: • The case of comparing different microprocessor technologies • Peripheral interfacing methodology • Peripherals' functions, technologies, and their use case scenarios via various multiple examples which are provided by the end of each chapter.
Control Theory	Learning objective: Introduce the terminology and the basic structure of control systems to the student Content: • Laplace transforms revision • Dynamic models and dynamic response • Industrial models of control systems • Basic concepts of feedback control systems • Stability concept • Routh–Hurwitz stability criterion • Compensator design using root locus plots • Nyquist stability criterion • Stability margins • Compensator design using bode plots
Information & Coding Theory	Includes the topics related to information theory whereas it studies: • Discrete memoryless channels • Data source coding as: block coding and Kraft inequality • Average length and compact codes • Shanon's theorem and Fano coding • Huffman coding • Error correcting codes: minimum space fundamentals, the relation between space and error correcting properties for codes. • Hamming distance • Parity check • The limits of error correction ability of parity checking

Systems & Circuits Modelling	This module covers the following: • Digital modelling of analog and mixed signal circuits using a hardware description language (VHDL-AMS): whereas we study the structure and the function of such languages that model and simulate the operation of analog and mixed signal circuits • Applications in circuit modelling such as: Diodes, BJTs, MOSFETs, Op-Amps, encoder circuit in PCM system, flow charts, etc...
Television Systems	This module covers the analog TV where it studies: light, the three primary colors, Television system design, the design of television receiver components and colored TV systems: SECAM, PAL, and NTSC. It also discusses: • Color picture tubes • TV sound systems • Digital TV fundamentals: ○ TV signal segmentation and quantization ○ ADCs and DACs ○ Digital TV experience ○ HDTV ○ 3D TVs • TV Cameras • Displays as: ○ Plasma Display Panels (PDPs) ○ Liquid Crystal Displays (LCDs)
Radar & Sonar Engineering	This module covers the following topics: • The basic elements of radar systems: antennas, transmitters, receivers, interfacing devices, doppler effect, continuous waves, array antennas, and duplexers • Effective aperture • Radar blinding • Pulse compression • Time-Bandwidth product • Surface and volume clutter • Moving Target Indication (MTI) • Noise reduction • Target tracking which includes: ○ Single target tracking ○ Multiple target tracking ○ High precision tactics • Synthetic Aperture Radar (SAR)

	• Sonar engineering including:
	  ○ Towed array sonar system
	  ○ The need of array of:
	  ▪ Hydrophones
	  ▪ Acoustic telemetry
	  ○ Directivity
	  ○ Radiation patterns
	  ○ Ultrasound propagation
	  ○ Target strength
	  ○ Sonar equations

Landline Telephone Communications	This module introduces the fundamental topics and information of landline telephone systems. It starts with a theoretic and practical study of landline phones as an integral part in telephone communications and it covers:
	• Central phone and tandem offices, their development, their functioning principles (using block diagram), their sections, and their mechanisms.
	• The study of switching systems, control, signaling, etc...
	• The time-based and probabilistic study of programmed automated telephony systems:
	  ○ The analytical and mathematical study of central and tandem office systems such as: traffic, collective service, and holding service.
	  ○ Apply the descriptive rules of systems' way of functioning where we can put a mathematical model of the system functioning.
	• The design aspect of switching networks in their various types: time-based, spatial, and hybrid.

Antennas	This module covers the essential concepts of antennas which includes:
	• Different antennas properties and their Radiation patterns.
	• Antenna types such as:
	  ○ Monopoles and dipoles
	  ○ Loop antennas
	  ○ Broad band antennas
	  ○ Travelling wave antennas
	  ○ Conical antennas
	  ○ Array antennas such as:
	  ▪ Reflective array antenna
	  ▪ Yagi-Uda antenna
	  ▪ Micro-strip antennas (Square strip and circular strip)
	  ○ Aperture antennas

Computer Networks	This module study the computer networks including: • OSI reference model services and standards which in turn includes the

	7 layers: ○ Physical layer: transmission media, Ethernet, and NICs ○ Media access layer: wire, wireless, radio, and optical access networks, and access standards ○ Data link layer: fundamental link, character oriented, bit oriented, and ALOHA protocols. IEEE 802 standards for LANs, data link layer devices. ○ Network layer: a look towards TCP/IP model, addressing, subnetting, network layer protocols, and routing algorithms. ○ Transport layer: congestion control algorithms, connection management, and the study of transport layer protocols. ○ Higher level layers of OSI and services of application layer. • LAN technologies (physical and logical) and its structure • Network standards and local systems
Optical Communications	This module covers the topics related to optical communications where it discusses: • An introduction to fiber optic communications • Fiber optics use cases • The general structure of a fiber optic based communication system • Fiber optic as a waveguide • Ray and mode light propagation theories • Cylindered fiber optics • Fiber optic cables • Light sources: LEDs, LDs • Light detectors: PN, PIN, and APD photodiodes • Couplers and connectors • Direct modulation techniques for LED and LD and their circuitry • Optical amplifiers: SOA and EDFA amplifiers
Cellular & Mobile Communications	This module starts with an introduction to mobile radio systems and the fundamentals of cellular system design. It basically studies 1G, 2G, 3G, enhanced 3G and 4G networks. It covers the following: • The structure and design of the aforementioned networks • Access, Allocation, and transmission techniques • Signal processing and modulation techniques • The protocols used in these networks • Description of the most important applications and data transmission use cases the make use of these networks • The integration of these networks with other data transmission networks including the internet.

Digital Image & Audio Processing	This module covers the following:
	• An introduction to image processing
	• The basic relations among image elements
	• Image types
	• Digital image processing and storage in computer and their importance
	• Image analysis
	• Computer-generated imagery
	• Image enhancement:
	  ○ Digital image enhancement
	  ○ Image histogram modification
	  ○ Smoothing and intensity of digital image
	• Segmentation and reconstruction
	• Digital image compression and compression methods
	• Some digital image processing applications
	• Spatial frequency
	• Pattern recognition
	• Image encryption

Ultrasonic Waves Applications	This module covers the following:
	• A general introduction to acoustic engineering
	• Acoustic wave propagation
	• Acoustic channel
	• Electro-Acoustic path
	• Octave
	• Tone interval and its relation to frequency
	• Loudness, its relation to intensity, and Equal-loudness contours
	• Electro-Acoustic devices such as:
	  ○ Microphones
	  ○ Speakers
	  ○ Electro-Mechanic audio transducers
	  ○ Electro-Dynamic microphones
	  ○ Electrical microphones
	  ○ Audio recording devices
	  ○ Acoustic studio devices
	• Acoustic measurements
	• Acoustic insulation
	• Equivalent electrical and mechanical circuits of acoustic systems
	• An introduction to ultrasonic oscillations and waves.
	• Wave amplification in fluids and rigid bodies
	• An introduction to Acoustoelastic effect
	• The transmission, reflection, deflection, radiation, scattering of ultrasonic waves.
	• Rayleigh and lamb waves

	• Ultrasonic waveguides • Piezoelectric crystal ultrasonic transducers • acoustic sensors such as: SAW, SH APM, FPW, and thickness shear mode resonator • The analysis and comparison of sensitivity • Sensitivity physics of fluids • Chemical gas sensors • Acoustic microscope • Acoustic cavitation • Time-Reversal Mirrors (TRMs) • Pico-second ultrasonic waves • Air coupled ultrasonic waves

Network Protocols	This module covers internet protocols as follows:
	• Data link protocols:
	  ○ HDLC, LAPD, ATM Protocols Architecture
	• Routing protocols: RIP, RIPv2, OSPF, IGRP (Cisco), EIGRP (Cisco), IS-IS, BGP. The properties, architecture, messages structure, operation mechanism, and applications of each protocol are discussed.
	• Multicast protocols including:
	  ○ host-router protocols: IGMP v1, v2, v3
	  ○ router-router protocols: CBT, MBONE, MOSPF, PIM-DM, PIM-SM, DVMRP
	• Routing techniques such as: MPLS, Service provider networks.
	• Real time multimedia transmission protocols

Internet Technologies	This module covers:
	• An introduction to the internet
	• Internet structure
	• Internet Service Providers (ISPs)
	• Internet structure comparison
	• Intra-nets
	• Extra-nets
	• Virtual Private Networks (VPNs)
	• XDSL's 2 types:
	  ○ Symmetric Digital Subscriber Line: SDSL, SHDSL, HDSL
	  ○ Asymmetric Digital Subscriber Line: ADSL, ADSL2, ADSL2+, VDSL, VDSL2.
	• Internet applications such as: E-Commerce, World Wide Web, Multimedia applications over internet, VoIP, etc...

Field Training	Learning objective: To provide the students with scientific knowledge related to topics covered in

	prior years. Whereas the department contact some private sector companies and the faculty labs (which are related to communications, electronics, and software topics) such as: • Syrian Telecom • General Organization of Radio and TV - Syria (ORTAS) • Software labs: in the aim of learning special purpose or new programming languages. The students are assigned to the aforementioned sites by the department.

Network Design & Planning	This module discusses the following:
	• Requirements and goals of network design: Customer requirements, networks, and devices
	• Efficient LAN architecting methods through:
	  ○ Server locating
	  ○ Using appropriate transfer media and devices
	• WAN designing and building methods starting from network requirements and to differentiate between flat design methods and 3 layer hierarchical method (Access, distribution, and core layers) where the learners study the functions and tasks of each layer and how to construct the efficient designs.
	• The process of enhancing the performance of the network through studying QoS parameters, network congestion detection, control, and avoidance.
	• Access Control Lists (ACLs)

Advanced Mobile Communications	This module studies the advanced and latest topics in mobile and cellular networks. Fundamentally covering Post 3rd generation mobile networks (evolved 3G networks) and 4G network including: • The structure and design of these networks • Their access, allocation, and transport techniques • Modulation methods and techniques • Signal processing in mobile networks • Communication protocols used in these networks • Communication and data transmission applications that benefit from these networks • Integration with other data transmission networks including internet.
Network Labs	This module covers the study of cables, switches, and routers in addition to addressing, subnetting, network installing, and router configuring. It also includes routing algorithms and protocols such as RIP, OSPF, IGRP, BGP, and Autonomous systems. Furthermore, it discusses LAN design, network simulation, NAT, and ACL.

Software Applications in Communications	This module is to study the modelling and simulation of communications systems and circuits as well as the techniques of modulation using the appropriate software packages. Also the studying of cellular and mobile communications, Antenna design using specialized pieces of software respectively.
Nano-Technologies	This module studies nano-technology and micro-technology engineering and the applications of MEMS systems. Also includes: • The mathematical mode • Microelectromechanical system design • Classic mechanics and its applications • Atomic structure and quantum mechanics • Designing the shape, model, and simulation. • Micromechanical systems • Sensors packaging • Micromechanical switch • Induction motor • Permanent magnet stepper motor • Nano machines: motors and generators • Fundamentals in electromagnetic radiation • Antennas in MEMS • Control in MEMS

Satellite Communications	This module covers the topics related to satellite systems and its classification, features, orbits, look angles, orbit effects on satellite systems. It also includes:
	• Spacecrafts
	• Satellite antennas
	• Standard devices
	• Spacecraft production
	• Uplink design
	• Communication link design for a specific Carrier/Noise Ratio
	• Modulation
	• Multiplexing techniques for satellite links
	• Multiple access for satellite links such as
	  ○ Time Division Multiple Access (TDMA)
	  ○ Frequency Division Multiple Access (FDMA)
	  ○ Code Division Multiple Access (CDMA)
	• Error detection and correction techniques
	• Wave propagation in satellite-earth paths and its impact on link design
	• Ground station technologies
	• Intelsat and Inmarsat architectures and strucures
	• Satellite television

Wireless Sensor Networks (WSN)	This module includes:
	• An extensive introduction to WSNs, its importance, its applications, and its structure (on the node and network level)
	• The architectural network model of these networks.
	• The extensive study of each layer in this model:
	  ○ The physical layer (modulation and encoding techniques)
	  ○ Data transmission techniques
	  ○ Access methods to the shared medium
	• Naming and addressing methods
	• Routing mechanisms and protocols used in WSNs
	• Localization and locating methods
	• Synchronization
	• Network structure control methods
	• Deployment methods
	• Most important and updated applications and directions in WSNs sector.

Reliability & Calibration	This module covers the study of reliability, reliability networks, and reliability assessment tools. As well as: • Maintenance feasibility and its tools, costs, costs of lifecycle, human factor effects on it. • Predictive and corrective maintenance • Management and cost of maintenance • Human errors in engineering maintenance • Safety and hazards in engineering design • Error models • Effects assessment • Fault detection and fault tolerance • Software reliability and software fault mechanisms • Software reliability measurements and models • Software testing

Programming & Managing Networks	This module includes:
	• Java & Python fundamentals (since they're used mainly in networking domain)
	• Network application programming:
	  ○ Client/Server applications using UDP/TCP sockets and error handling
	  ○ Server-side code development methods to handle large number clients using threaded multiple path execution and asynchronous communications
	• Server configuring, administrating, and initializing the main services:

	○ Active Directory server ○ Web server ○ Etc... • Making use of the basic libraries used in data and web mining and processing using Python as a HTTP client. • Tracking and detecting exchanged packets in networks for performance assessment • Designing and programming websites using Flask framework • The transition to Software-Defined Networks (SDN) and the comprehension of the functioning and the interfacing of controllers with regular network devices.
Artificial Intelligence (AI)	The learning objective of this module is to introduce the students with new smart systems' concepts. The module includes a general glance on different machine learning methods: • Decision tree • Inference • Regression • Bayesian method The main focus of the module will be on Neural Networks, genetic algorithms, reinforcement learning, and adaptive control.
Graduation Project	According to department's curriculum
Microwave Circuits	This module covers the following: • Microwave integrated circuits and its technologies: ○ Monolithic Microwave Integrated Circuit (MMIC) ○ Thin & thick film fabrication • Microwave transistor amplifier design • Semiconductors microwave devices: PIN Diode, Schottky Diode, Gunn Diode, Tunnel Diode, etc... • Stability circles • Narrow-band microwave amplifier design • Amplifier design for: maximum gain, low noise cases. • Microwave oscillators • Millimetric microwave systems: ○ Microwave oscillator design ○ Two port microwave oscillators ○ Low noise, and maximum gain design scenarios • Practical oscillator circuits
Network Security	This module is about the study of Networks security whereas it discusses: • Security implementation elements

	• Confidentiality, reliability, ciphering, and privacy fundamentals
	• Encryption such as block chain encryption
	• Data encryption standards
	• Symmetric encryption algorithms: DES, AES
	• Asymmetric encryption algorithms
	• Data integrity fundamentals
	• Authentication
	• Hashing algorithms: MD5, SHA
	• Data source authentication
	• Message Authentication Codes (MACs): HMAC, MD5
	• Authorization, non-repudiation, and access control as in: digital signature, certificates, managing and distributing digital certificates (as in PKI architecture)
	• Network security study cases:
	  ○ E-mail security
	  ○ IPSec
	  ○ Web security
	  ○ Intruders and countermeasure software

Head of Communication and Electronics engineering department

Prof. Dr. Haisam Alradwan

Dean of Mechanical and Electrical Engineering Faculty

Prof. Dr. Michel Barbahan