People's Democratic Republic of Algeria الجمهورية الجزائرية الديمقراطية الشعبية

وزارة التعليم العالي والبحث العلمي

Ministry of Higher Education and Scientific Research

اللجنة البيداغوجية الوطنية لميدان العلوم و التكنولوجيا

National Pedagogical Committee of the Science and Technology field

TRAINING OFFER
L.M.D.

ACADEMIC MASTER's DEGREE

A NATIONAL REGISTRATION
2024– 2025
(1st update)

Establishment	Faculty / Institute	Department
M'Hamed Bougara-Boumerdes University	**Institute of Electrical and Electronic Engineering**	**Electronic**
Domain	Major	Speciality
Sciences and Technologies	***Telecommunications***	***Telecommunications***
Ministerial Order No. 1072 of 13 October 2015, on the accreditation of the Master of National Registration, UMBB.		

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عرض تكوين
ل. م . د
ماستر أكاديمية

ذا تسجيل وطني

2024 –2025
(التحيين الأول)

المؤسسة	الكلية/ المعهد	القسم
جامعة أمحمد بوقرة- بومرداس	معهد الهندسة الكهربائية والإلكترونيك	الإلكترونيك
الميدان	**الفرع**	**التخصص**
علوم وتكنولوجيا	إتصالات سلكية ولا سلكية	إتصالات سلكية ولا سلكية
قرار وزاري رقم 1072 المؤرخ في 13 أكتوبر 2015، يتضمن تأهيل ماستر فروع تسجيل وطني، جامعة بومرداس		

II – Semester organisation sheets for teaching of the specialty

Semester 1

Teaching unit	Materials: Code	Materials: Entitled	Credits	Coefficient	Weekly hourly volume: Lecture	Weekly hourly volume: Recitation	Weekly hourly volume: Lab	Semi-Annual Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Evaluation method: Continuous assessment	Evaluation method: Examination
Fundamental UE.1 Code: UEF 1.1.1 Credits: 15 0Coefficients: 8	EE411	Microwave Engineering	5	3	3h00			45h00	45h00	40%	60%
	EE413	Communication Circuits	5	2	3h00			45h00	45h00	40%	60%
	EE415	Advanced Communications	5	3	3h00			45h00	45h00	40%	60%
Fundamental UE.2 Code: UEF 1.1.2 Credits: 10 Coefficients: 6	EE461	Advanced Electromagnetic Field Theory	7	4	3h00	2h00		75h00	75h00	40%	60%
	EE463	Radio Wave Propagation	3	2	1h30	1h30		45h00	45h00	40%	60%
Methodological UE Code: EMU 1.1.1 Credits: 4 Coefficients: 2	EE413L	Communication Circuits Lab	2	1			15h00	45h00	45h00	100%	
	EE417	Networks and Protocols	2	1	1h30		2h00	52h30	52h30	40%	60%
Discovery UE Code: UED 1.1.1 Credits: 1 Coefficients: 1	EE425	Information security	1	1	1h30			10h30	10h30		100%
Semester 1 total			**30**	**17**	**16h30**	**3h30**	**5h00**	**375h00**	**375h00**		

Semester 2

Teaching unit	Materials		Credits	Coefficient	Weekly hourly volume			Semi-Annual Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Evaluation method	
	Code	Entitled			**Lecture**	**Recitation**	**Lab**			**Continuous assessment**	**Examination**
Fundamental UE.1 Code: UEF 1.2.1 Credits: 7 Coefficients: 4	EE416	Antennas	4	2	3h00			45h00	45h00	40%	60%
	EE442	Electrical Networks Analysis and Design	3	2	3h00			45h00	45h00	40%	60%
Fundamental UE.2 Code: UEF 1.2.2 Credits: 11 Coefficients: 6	EE418	Image Processing	3	2	3h00			45h00	45h00	40%	60%
	EE 412	Discrete-time Signal Processing	4	2	3h00			45h00	45h00	40%	60%
	EE414	Information Theory and Coding	4	2	3h00			45h00	45h00	40%	60%
Methodological UE 1 Code: EMU 1.2.1 Credits: 4 Coefficients: 2	EE416L	Antennas Lab	2	1			1h30	22h30	22h30	100%	
	EE442L	Electrical Networks Analysis and Design Lab	2	1			1h30	22h30	22h30	100%	
Methodological UE 2 Code: EMU 1.2.2 Credits: 6 Coefficients: 3	EE418L	Image Processing Lab	2	1			1h30	22h30	22h30	100%	
	EE412L	Discrete-time Signal Processing Lab	2	1			1h30	22h30	22h30	100%	
	EE414L	Information Theory and Coding	2	1			1h30	22h30	22h30	100%	
Transversal UE Code: UET 1.2.1 Credits: 1 Coefficients: 1	EE482	Standards and rules of Ethics and Integrity	1	1	1h30			22h30	22h30		100%
Discovery UE Code: UED 1.1.1 Credits: 1 Coefficients: 1	EE462	Electromagnetic Compatibility	1	1	1h00			15h00	15h00		100%
Semester 2 total			**30**	**17**	**17h30**		**7h30**	**375h00**	**375h00**		

Semester 3

Teaching unit	Materials		Credits	Coefficient	Weekly hourly volume			Semi-Annual Hourly Volume (15 weeks)	Complementary work in Consultation (15 weeks)	Evaluation method	
	Code	Entitled			**Lecture**	**Recitation**	**Lab**			**Continuous assessment**	**Examination**
Fundamental UE.1 Code: UEF 2.1.1 Credits: 12 Coefficients: 6	EE515	Optical Fiber Communication Systems	5	3	3h00			45h00	55h00	40%	60%
	EE517	Radar Systems	5	3	3h00			45h00	55h00	40%	60%
Fundamental UE.2 Code: UEF 2.1.2 Credits: 11 Coefficients: 6	EE541	RF and Microwave Circuits Design	6	3	3h00			45h00	55h00	40%	60%
	EE511	Wireless Communication	5	2	3h00			45h00	55h00	40%	60%
Methodological UE Code: EMU 2.1.1 Credits: 4 Coefficients: 2	EE515L	Optical Fiber Communication Systems	2	1			3h00 pm	45h00	25h00	100%	
	EE541L	RF and Microwave Circuits Design Lab	2	1			3h00 pm	45h00	25h00	100%	
	EE517L	Radar Systems Lab	2	1			2h00	30h00	25h00	100%	
Transversal UE Code: UET 2.1.1 Credits: 2 Coefficients: 2	EE581	Project Management	1	1	1h30			10h30	25h00		100%
	EL501	Communication Skills	1	1	1h30			10h30	25h00		100%
Discovery UE Code: UED 2.1.1 Credits: 1 Coefficients: 1	EE513	Machine Learning and Deep Learning	1	1	2h00			30h00	30h00		100%
Semester 3 total			**30**	**17**	**17h00**		**8h00**	**375h00**	**375h00**		

Semester 4

	VHS	Coeff	Credits
Personal work	750	17	30
Total Semester 4	750	17	30

The personal work consists of the preparation of a Master's thesis which may include an internship in a socio-economic environment and/or participation in seminars. It is sanctioned by a defense.

Its method of evaluation is done in accordance with the regulations in force.

III - Detailed programme by subject of the S1 semester

Semester:1
Teaching unit: UEF1.1.2
Material 5: Microwave Engineering
VHS: 45h00 (Lecture: 3h00, TD: 00)
Credits: 6
Coefficient: 3

Teaching objectives:

Knowledge to design microwave transmission lines and waveguides, design impedance matching networks for specific applications and be familiar with S-parameter terminology to describe circuits and microwave components.

Recommended prior knowledge:

Calculus, Circuits and Electromagnetic Field Theory.

Material content:

- Introduction to Microwave Engineering
- Transmission Lines
- Some Specific Guiding Systems
- Microwave Wave-Guides
- Scattering Parameters
- Microwave Components

Evaluation method:

Continuous assessment : 30%; Examination: 70%.

References:

1. Pozar David M., "Microwave Engineering", Fourth Edition, John Wiley, 2011.
2. Robert E. Collin, "Foundations of Microwave Engineering," Second Edition, John Wiley, 2007.
3. Peter A. Rizzi, "Microwave Engineering: Passive Circuits," First Edition, Prentice Hall; 1987.

Semester:1
Teaching unit: UEF1.1.1
Subject 1: Circuit communications
VHS: 45h00 (Course: 3h00)
Credits: 5
Coefficient: 2

Teaching objectives:

At the end of the course, the student must master basic electronic circuits used incommunication such as passive coupling networks, oscillators, mixers and modulators, smallsignal IF and RF amplifiers and power amplifiers.

Recommended prior knowledge:

Students must have a good knowledge of elementary electronic circuits and networks. They must also know the basic modulations.

Material content:

Chapter 1: Review of electronic devices and biasing
Chapter 2 : Passive coupling networks, Q transformations, transformer like networks
Chapter 3 :Nonlinear controlled sources: Piecewise linear, square law, exponential, differential,effect of series resistance, resistively biased BJT
Chapter 4: Σινυσοιδαλ οσχιλλατορσ**:** Wien bridge oscillator, LC oscillators
Chapter 5 :Receiver circuits: Super heterodyne principle, mixers (passive and active), RF amplifierdesign (noise and interferences), IF amplifier design (y parameter design procedures)
Chapter 6: Τρανσμιττερ χιρχυιτσ: Power amplifiers (class A, B and C)

Evaluation method:

Continuous assessment: 40%;   Examination: 60%.

Bibliographical references:

Communication Circuits: Analysis and Design, K. K. Clarke and D. T. Hess, AddisonWesley, Reading, Mass. 1971.

Semester 1
Teaching unit : UEF 1.1.1
Subject 2: Advanced communications
VHS: 45h00 (Lecture: 3h00, TD: 00)
Credits: 6
Coefficient: 3

Teaching objectives:

At the end of the course, the student should be able to analyze communication systems using a probabilistic point of view. The course insists on digital communication using signal space methods.

Recommended prior knowledge:

- Probability and random variables.
- Signal and system theory (Fourier methods).

Material content:

- Review of Probability and Random Variables.
- Introduction to Stochastic Processes.
- Baseband Communication Systems.
- Basic Digital Modulation.
- Signal Space Methods.
- An introduction to Coding.

Evaluation method:

Continuous assessment: 30%; Examination: 70%.

Bibliographical references:

1. B. Carlson, *Communication Systems*, 5th ed. Mcgraw Hill Higher Education, 2009
2. S. Haykin and M. Moher, *An Introduction to Analog and Digital Communications*, 2nd ed. Wiley, 2006.

Semester:1
Teaching unit: UEF 1.1.2
Subject 4: Advanced Electromagnetic Field Theory
VHS: 67h30 (Lecture: 3h00, TD: 1h30)
Credits: 7
Coefficient: 5

Teaching objectives (*Describe what skills the student is expected to have acquired after success in this subject – maximum 3 lines).*

The main objective of this course is to help students to learn basic knowledge about the fundamentals of the mechanism of EM waves propagation and radiation. After this course, the student will

- understand the basis of the propagation of electromagnetic (EM) waves and know the parameters that describe this propagation,
- learn how to characterize electromagnetically the different media,
- learn the fundamentals that determine the controlled radiation of the EM waves. This includes concepts related to antennas.

Recommended prior knowledge (*brief description of the knowledge required to be able to follow this course – Maximum 2 lines).*

- Basic knowledge on electromagnetic field theory (EMF): This includes Calculus I and Calculus II, Linear algebra, and Physics.

Content of the material:

- Electromagnetic (EM) waves propagation in unbounded media
- EM Energy and boundary conditions
- Reflection and Transmission of EM waves
- EM potentials
- EM Theorems

Method of evaluation:

Continuous assessment: 40%; Examination: 60%.

References *(Books and handouts, websites, etc.).*

1. Hayt, William H., and Buck, John A. Engineering Electromagnetics. McGraw-Hill Education, 9th Edition, 2018.
2. Sophocles J. Orfanidis, Electromagnetic Waves and Antennas, 2008.
3. Sadiku, Matthew. Elements of Electromagnetics. Oxford University Press, 7th Edition, 2018.
4. Cheng, David K. Fundamentals of Engineering Electromagnetics. Pearson, 1st Edition, 2019.

Semester: 1
Teaching unit: UEF 1.1.2
Subject1: Radio wave propagation
VHS: 45h00 (Lecture: 1h30, TD: 1h30)
Credits: 4
Coefficient: 2

Teaching objectives:

This course aims to provide a comprehensive knowledge of fundamentals of radio wave propagation in real telecommunication systems.

Recommended prior knowledge:

Electromagneticfieldtheory.

Content of the material:

- Introduction
- Ground wave propagation
- Ionosphere effects on radio wave propagation: Sky wave propagation
- Line of sight propagation

Method of evaluation:

Continuous assessment: 40%; Examination: 60%.

Bibliographical references:

1. J. S. Seybold, "Introduction to RF Propagation" John Wiley & Sons Inc., 2005.
2. R. L. Freeman, "Radio System Design for Telecommunications" John Wiley & Sons Inc., 2007.
3. C. Haslett, "Essentials of Radio Wave Propagation" Cambridge University Press, New York, 2008.
4. H. Sizun, "Radio Wave Propagation for Telecommunication Applications" Springer, 2005.

Semester: 1
Teaching unit: UEM 1.1
Subject 1: Circuit Communications Laboratory
VHS: 30h00 (TP: 2h00)
Credits: 2
Coefficient: 1

Teaching objectives:

This is an accompanying set of laboratory experiments to the communication circuit course. At the end of the course, the student should be able to design typical communication circuits such as oscillators, modulators, amplifiers.

Recommended prior knowledge:

The student must absolutely know basic lab procedures and should have a working knowledge of a SPICE based software.

Material content:

Evaluation method:

Continuous Assessment: 100%

Bibliographical references:

Communications Circuits lab. Manual, Prof. A. Dahimene

Semester:1
Teaching unit: UEM 2.1
Subject 7: Networks and protocols
VHS: 52h00 (Lecture: 1h30, TP: 2h00)
Credits: 2
Coefficient: 1

Teaching objectives:

The goal of this course is to bring the student to understand thoroughly the network protocol mechanisms, the roles and functions of the intermediate equipments, such as routers and switches.

Recommended prior knowledge:

The student should have an insight about numbering systems, basic Boolean algebra and computer architecture.

Material content:

1-Goals of Networking, physical media, RS232 based communication
2- host-to-host communication, packet switching, framing, CRC, stop and wait protocol, sliding window protocol
3- Multiple colocated hosts: addressing, ethernet (CSMA/CD), Token Ring (FDDI), MACAW (wireless LANs), bridges
4- Internetworking, addressing, ATM cell switching, LANE
5- IP routing algorithms, RIP, OSPF, BGP
6- End-to-end communication: UDP, TCP, RPC
7- Congestion control (Router based, process based)
8- Applications: DNS, HTTP
9- Advanced Topics: Network Intrusion Detection, SNMP

The laboratory experiments will be performed using one of the following simulation softwares:

- Packet tracer V3.3.1 of Cisco Academy
-GNS

- Introduction to Packet Tracer and GNS3
- Configuration of Router (s) used in a LAN
- Configuration of Switch (es) used in LAN (VLAN configuration).
- LANs interconnections (MANs or/and WANs)

Method of evaluation:

Continuous assessment: 40%; Examination: 60%.

Bibliographical references :

1. Cisco CCNA V4.1, Exploration official course, 2011-2012

2. A. S. Tanenbaum, D. J. Wetherall, "Computer Networks," 5th Edition, Prentice Hall, 2010
3. G. Pujolle, "Les réseaux", 7th Edition, Eyrolles, 2011.

1. Cisco CCNA V4.1, Exploration official course, 2011-2012
2. A. S. Tanenbaum, D. J. Wetherall, "Computer Networks," 5th Edition, Prentice Hall, 2010
3. G. Pujolle, "Les réseaux", 7th Edition, Eyrolles, 2011.

Semester: 1
Discovery UE: UED 1.2.1
Subject 8: Information Security
VHS: 22h30 (Lecture: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

The objective of a course in information security is to educate students on principles, practices, and technologies aimed at protecting sensitive information from unauthorized access, disclosure, alteration, or destruction. It covers topics such as risk management, encryption, network security, access control, and incident response, among others, to equip students with the knowledge and skills needed to safeguard digital assets and mitigate cybersecurity threats

Recommended prior knowledge:

Basic understanding of computer systems. Proficiency in fundamental computing skills, such as using operating systems like Windows or Linux, and knowledge of programming languages such as Python or Java may also be beneficial.

Material content:

1--introduction to Information Security2-overview of cybersecurity threats and challenges3-importance of information security in modern society4-basic principles and concepts of information security5-fundamentals of Computer Systems and Networks6-understanding computer architecture and components7-introduction to networking protocols and technologies8-basics of operating systems and their security features9-cryptography and Data Encryption10-applications of cryptography in securing data and communications.
11-common network security threats and vulnerabilities

Evaluation method:

Review: 100%.

Bibliographical references:

1. Anderson, R. Security Engineering: A Guide to Building Dependable Distributed Systems. UK: Wiley.2020.

2. William stallings 'cryptography and Network Security ' 8th. Edition. William Stallings.Pearson.2013.

IV - Detailed programme by subject of the S2 semester

Semester: 2
Teaching unit: UEF 1.2.1
Material 1: Antennas
VHS: 45h00 (Lecture: 3h00, TD: 00)
Credits: 4
Coefficient: 2

Teaching objectives:

The objective of this course is for each student to be able to design basic antenna and array structures, know the terminology of antennas, understand the concepts of antenna analysis, and be familiar with the major antenna and array type.

Recommended prior knowledge:

Calculus and Electromagnetic Field.

Material content:

- Introductions to Antennas
- Fundamental Parameters of Antennas
- Radiation of a Source in Unlimited Medium
- Theory of Radiating Apertures
- Microstrip Patch Antennas
- Antenna Arrays
- Theory of Antenna Arrays
- Linear Antenna Arrays
- Planar Antenna Arrays

Evaluation method:

Continuous assessment: 30%; Examination: 70%.

Bibliographical references:

1. C. A. Balanis, "Antenna Theory: Analysis and Design," Third Edition, John Wiley, 2005.

2. W. L Stutzman and G. A. Thiele, "Antenna Theory and Design," Second Edition, John Wiley, 1998.

3. J. D. Kraus and R. J. Marhefka, "Antennas for All Applications," Third Edition, 2002.

4. L. V. Blake and M. W. Long, "Antennas: Fundamentals, Design, Measurement," Third Edition, Scitech Publishing, 2009.

Semester:2
Teaching unit: UEF 1.2.1
Subject 2: Electrical Networks Analysis and Design
VHS: 45h00 (Lecture: 3h00, TD: 00)
Credits: 4
Coefficient: 2

Teaching objectives (*Describe what skills the student is expected to have acquired after success in this subject – maximum 3 lines).*

The main objective of this course is to help students to learn various electrical circuits' analysis techniques, familiarize with two-port networks and learn various frequency response plots and understand their significance in active filters design.

Recommended prior knowledge (*brief description of the knowledge required to be able to follow this course – Maximum 2 lines).*

- Differential equations and computational methods.

Content of the material:

- Review and Generalities
- Introduction to Graph theory
- Topological Network Analysis
- Multi-port Networks Analysis
- Active Filters Design

Method of evaluation:
Continuous assessment: 30%; Examination: 70%.

References *(Books and handouts, websites, etc.).*

1. M. E. Van Valkenburg, "Network Analysis", 3rd Edition, Prentice Hall, Inc.
2. M. Arshad, "Network Analysis & Circuits," Jones & Bartlett Learning, 1st edition, 2010.
3. J. D. Irwin and R. M. Nelms "Basic Engineering Circuit Analysis", 12th Edition, Wiley, 2020
4. W. Hayt, J. Kemmerly and S. Durbin, "Engineering Circuit Analysis", McGraw-Hill, 7th Edition, 2007.
5. C. Alexander and M. Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill, 4th Edition, 2008.
6. S.A. Pactitis, "Active Filters: Theory and Design", CRC Press, 1st edition, 2018.

Semester: 2
Teaching unit: UEF 1.2.2
Subject 1: Image processing
VHS: 45h00 (Lecture: 3h00, TD: 00)
Credits: 4
Coefficient: 2

Teaching objectives:

- To provide an introduction to basic concepts and methodologies for the formation, representation, compression, enhancement and analysis of digital images.
- To provide a foundation for developing applications and for further study in the field.

Recommended prior knowledge:

-Programming.
- Digital Signal Processing

Content of the material:

- Introduction
- Filtering in time and the frequency domain
- Edge detection
- Image Segmentation.
- Multiresolutionprocessing/Compression
- Classification.
- Applications.

Evaluation method:

Continuous assessment: 30%; Examination: 70%.

Bibliographical references:

1. Image Processing: The Fundamentals, Costas Petrou, Wiley 20102. Digital Image Processing Using MATLAB 2nd Ed. Gonzalez, Woods, and Eddins, 2009.

3. Digital Image Processing (3rd Edition)by Rafael C. Gonzalez, 2007.
4. Signal and Image Processing for Biometrics (ISTE) Amine Nait-Ali , Régis Fournier and Dalila Cherifi, Wiley 2012.

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Semester: 2
Teaching unit: UEF 1.2.2
Material 2: Discrete-time signal processing
VHS: 45h00 (Lecture: 3h00, TD: 00)
Credits: 4
Coefficient: 2

Teaching objectives:

This course will build on the knowledge acquired in the two preceding courses of signals and systems. The main objective of this course is to help students to design and implement digital filters using many different approaches. In addition to efficient algorithms for computing, the discrete-time Fourier transform.

Recommended prior knowledge:

Signals and Systems, Calculus

Material content:

Chapter 1:Review (2 weeks)
Basic building functions, properties of systems, LTI systems characterization, Discrete-time Fourier transform, Symmetry properties of the DTFT, The Z-transform, Properties of the Z-transform
Chapter 2: Sampling (1 weeks)
The ideal sampling, The relationship between the Fourier transform of an analog signal and its discrete version, Derivation of the sampling theorem of bandlimited signals, The reconstruction of signals from their samples (The interpolation theorem), Practical A/D conversion, Quantization.
Chapter 3: Finite Impulse Response Filters design (2 weeks)
Types of digital filters, Characteristics of practical frequency selective filters, Symmetric and anti-symmetric FIR filters, Design of linear phase FIR filters, The windowing method, The analysis of the filters designed by the windowing method, Types of windows, The Kaiser window, The Parks–McClellan algorithm, Examples of FIR filters: differentiators, Hilbert filter.
Chapter 4: Infinite Impulse Response Filters design (3 weeks)
Difference between FIR and IIR design, Constraints on the IIR design methods,Mapping method, Impulse invariance method, Bilinear transformation method,Prototype analog filters, Butterworth filter, Chebyshev filter, Elliptic filter.
Chapter 5: The Discrete Fourier Transform (DFT) (3weeks)
Definition, the derivation of the DFT from the DTFT, Properties of the DFT, Matrix form of the DFT, Circular convolution, Linear convolution vs Circular convolution, Linear filtering using DFT
Chapter 6: The Fast Fourier Transform (FFT) (2 weeks)
Definition, Divide-and-conquer algorithm, Radix-2 FFT, Decimation-in-time, Decimation-in-frequency.
Chapter 7: Signal Flow graph and implementation (2 weeks)
Definition,basic elements of a signal flow graph, structures for FIR filters, cascade and parallel structures for FIR filters,structures for IIR filters, cascade and parallel structures for IIR filters, Transposed structures, Quantization errors in IIR filters, second-order structures for IIR filters.

Evaluation method:

Continuous assessment: 40%; Examination: 60%.

Bibliographical references:

1. J. G. Proakis, and D. G. Manolakis, "Digital Signal Processing, principles, algorithms, and applications" Prentice-Hall, 3rdedition 1996.

2. A. V. Oppenheim, and R. W. Schafer, " Discrete-time Signal Processing " Prentice Hall; 3rd edition, 2009.

Semester: 2

Teaching unit: UEF 1.2.2
Subject 3: Information theory and coding
VHS: 45h (Lecture: 3h00, TD: 00)
Credits: 4
Coefficient: 2

Teaching objectives:
At the end of the course, the student will understand fundamental concepts in communication theory.

Recommended prior knowledge:
- Advanced Communication.
- Basic Algebra.

Content of the material:

- Review of Basic Algebra (Galois Fields)
- Waveform Communication using Signal Space Methods.
- Introduction to Information Theory.
- Source Coding.
- Channel Coding.
- Introduction to Coding Theory.
- Linear Codes.
- Cyclic Codes.
- Convolutional Codes.
- Some Topics:
- Turbo Codes.
- Encoded Trellis.

Evaluation method:
Continuous assessment: 30%; Examination: 70%.

Bibliographical references:

1. J. G. Proakis, *Digital Communications*, 5th ed. McGraw-Hill, 2008.
2. P. Lafrance, *Fundamental Concepts in Communication*. Prentice Hall, 1992

Semester: 2
Teaching unit: UEM 1.2.1
Material 1 : Antennas Laboratory
VHS: 10:30 pm (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

These laboratory antennas experiments are designed to enhance the students' skills in understanding and learning of antennas design.

Recommended prior knowledge:

Basic understanding of antenna design and analysis methods.

Material content:

- Introduction to AntennasLaboratory
- An introduction to MATLAB
- Dipole Antenna
- Monopole and Loop Antennas
- Rectangular and Circular Aperture Antennas
- Linear and Circular Antenna Arrays
- Yagi-Uda Antenna
- Horn Antenna
- Microstrip Antenna

Evaluation method:

Continuous Assessment: 100%

Bibliographical references:

1. Balanis, C.A. Antenna Theory Analysis and Design, 2nd Edition. United States of America. John Wiley & Sons, pp. 734, 1997.
2. Sainati, R.A. CAD of Microstrip Antennas for Wireless Applications. Norwood, Mass. Artech House, pp. 87, 1996.
3. Laboratory Manual.

Semester: 2
Teaching unit: UEM 1.2.1
Subject 2: Electrical Networks Analysis and Design Laboratory
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

The purpose of this lab is to help students to become familiar with the equations that are used to describe two-port networks (TPNs), measure currents and voltages of a TPN and learn to use these measurements to calculate any of the two-port parameters, learn the use of the table for converting from one set of two-port parameters to another, learn practical methods to design different types of active filters.

Recommended prior knowledge:

Basic understanding of electrical networks design and analysis techniques.

Material content:

- Introduction to Electrical Networks Analysis and Design Laboratory
- Two port network (determination of open circuit impedance parameters (Z), short circuit admittance parameters (Y), transmission parameters (ABCD), hybrid parameters and g-parameters).
- Equivalent parameters of series connection of TPN.
- Equivalent parameters of parallel connection of TPN.
- ABCD parameters of the cascade connection of TPN.
- Active Filters Design (low pass filter, high pass filter, band pass filter and band reject filter)

Evaluation method:

Continuous Assessment: 100%

Bibliographical references:

1. M. E. Van Valkenburg, "Network Analysis", 3rd Edition, Prentice Hall, Inc.
2. M. Arshad, "Network Analysis & Circuits," Jones & Bartlett Learning, 1st edition, 2010.
3. J. D. Irwin and R. M. Nelms "Basic Engineering Circuit Analysis", 12th Edition, Wiley, 2020
4. W. Hayt, J. Kemmerly and S. Durbin, "Engineering Circuit Analysis", McGraw-Hill, 7th Edition, 2007.
5. C. Alexander and M. Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill, 4th Edition, 2008.
6. S.A. Pactitis, "Active Filters: Theory and Design", CRC Press, 1st edition, 2018.
7. Laboratory Manual.

Semester: 2
Teaching unit: UEM 1.2.2
Material 1: Image processing laboratory
VHS: 10:30 pm (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

To provide practical experience in the design and implementation of image processing algorithms.

Recommended prior knowledge:

- Algorithm and programming.
- C/C++ programming, Linux and Matlab

Material content:

- Introduction
- Filtering in time and the frequency domain
- Edge detection
- Image Segmentation.
- Multi resolution processing
- Classification.

Evaluation method :

Continuous assessment: 100%.

References

1. Image Processing: The Fundamentals, Maria Petrou, Costas Petrou, Wiley 2010
2. Digital Image Processing Using MATLAB 2nd Ed. Gonzalez, Woods, and Eddins, 2009.
3. Digital Image Processing (3rd Edition)by Rafael C. Gonzalez, 2007.
4. Signal and Image Processing for Biometrics (ISTE) Amine Nait-Ali , Régis Fournier and Dalila Cherifi, Wiley 2012.

Semester: 2
Teaching unit: UEM 1.2.2
Material 2: Discrete-time signal processing laboratory
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

After the completion of the experiments, the student will be able to perform basic signal processing operations such as convolution and correlation. Also, the student will be able to design diverse types of filters.

Recommended prior knowledge:

- Algorithmic and basic programming.

Material content:

1. Generation of elementary Discrete-Time sequences
2. Linear convolution
3.Verification of the sampling theorem
3. Auto correlation and Cross Correlation
4. Design of FIR filters (LPF/HPF/GPF/BSF)
5. Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF)
6. Frequency Analysis using DFT

Evaluation method :

Continuous assessment: 100%.

References

Vmay K Ingle, John G Proakis, Digital Signal Processing using MATLAB, Fourth Edition, 2017.

Semester: 2
Teaching unit: UEM 1.2.1
Subject 3: Information Theory and Coding laboratory
VHS: 22h30 (TP: 1h30)
Credits: 2
Coefficient: 1

Teaching objectives:

The student should be made to:
- Be exposed to the information theories and their coding.
- Learn to implement the algorithms of coding.
- Learn to use and apply the information theory and coding algorithms.

Recommended prior knowledge:

Probability, Linear algebra, Signal processing, Information theory, MATLAB

Material content

1. Review of Instructions, Statements, Tools and Functions MATLAB Programming Languages.
2. Implement the following coding algorithms:
3. Write a program for determination of various entropies and mutual information of a given channel. test various types of channel such that : noise free channel, error free channel, binary symmetric channel, noisy channel and compare the channel capacity of the above channels.
4. Write a program for generation and evaluation length variable source coding using MATLAB:
5. SHANNON -Fano coding and decoding
6. Huffman coding and decoding.
7. Lampel Zip coding and decoding.
8. Write a program for coding and decoding of LINEAR BLOCK CODE.
9. Write a program for coding and decoding of CYCLIC CODE.
10. Write a program for coding and decoding of CONVOLUTION CODE.
11. Write a program for coding and decoding of BCH and RS codes.

Evaluation method :

Continuous assessment: 100%.

References

1. M. Cover and J. A. Thomas, "Elements of information theory", 2nd edition, Wiley Series in telecommunications and signal Processing, 2006.

2. M. Barlaud, C. Labit, "Compression and coding of images and videos", treatise Collection IC2, Ed. Hermés, 319p, 2002.

3. K. Sayood, "Introduction to Data Compression, Third Edition", Elsevier Inc. 2006.

4. Olivier Rioul, "Théorie de l'information et du codage", Edit. Lavoisier, 2007.

5. N. Moreau, "Tools for Signal Compression: Applications to Audio Signals", Collection.

7. J. C., Moreira, P. G., Farrell, "Essentials of Error-Control Coding", John Wiley and Sons, Ltd, 2006.

8. C. Berrou, "Codes et turbocodes", Springer-verlag France, 2007.

Semester: 2
Transversal UE: UET 1.2.1
Subject 1: Standards and Rules of Ethics and Integrity
VHS: 22h30 (lecture: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

Develop student awareness regarding ethics and rules that govern life at both university and in the professional world. The course presents the risks and consequences of corruption that are raised by new technologies and sustainable development and eventually how to fight them.

Recommended prior knowledge:

Ethics & Integrity (Bachelor course)

Content of the material:

A. Compliance with the rules of ethics and integrity: (06 weeks)
1. Reminder of Ethics and Deontology of the MESRS: Integrity and Honesty. Academic freedom, objectivity and critical thinking. Equity. Rights and obligations of the student, teacher, and other staff,
2. Honest and responsible research
- Respect for the principles of ethics in teaching and research
- Responsibilities in teamwork: Professional equality of treatment. Conduct against discrimination.
- Plagiarism (definition of plagiarism, different forms of plagiarism, procedures to avoid unintentional plagiarism, etc.
3. Ethics and deontology in the professional life:
Legal confidentiality in business. Loyalty to the company. Responsibility within the company, Conflicts of interest.

B- Intellectual Property (04 weeks)
I- Fundamentals of intellectual property
II- Copyright
III- Protection and enhancement of intellectual property

C. Ethics, sustainable development and new technologies (05 weeks)
Link between ethics and sustainable development, energy saving, bioethics and new technologies (artificial intelligence, scientific progress, humanoids, robots, drones

Method of evaluation:

Review: 100%

Bibliographical references:

1. *Consult the two links* www.wipo.int, 2) http://www.app.asso.fr/
2. Orders No. 933 of 28 July 2016 laying down the rules relating to the prevention and fight against plagiarism
3. Carr, D. Professionalism and Ethics in Teaching. New York, NY Routledge. 2000.

Semester: 2
Discovery UE: UED 1.2.1
Material 2: Electromagnetic Compatibility
VHS: 15h00 (Lecture: 1h00)
Credits: 1
Coefficient: 1

Teaching objectives:

The objective of the course is the study of the issues related to electromagnetic interferences resulting from the widespread use of electronic devices operating in a close proximity to each other. This situation is a source of a major problem for equipment designers, and it is likely to become more severe in the future. The course also aims to provide materials and solutions to reduce these interferences and achieve electromagnetic compatibility (EMC).

Recommended prior knowledge:

Electromagnetic field theory - Electrical Engineering –

Material content:

- Introduction to Electromagnetic Compatibility (EMC)
- EMC Principles
- Solution to EMC problems
- EMC Requirements and Regulations

Evaluation method:

Review: 100%.

Bibliographical references:

3. Henry, W. Ott, Electromagnetic Compatibility Engineering, John Willey & Sons, 2009.
4. Clayton, A. Paul, Introduction to Electromagnetic Compatibility, John Willey & Sons, 2006.

V - Detailed programme by subject of the S3 semester

Semester: 3
Teaching unit: UEF 1.2.2
Material 1: Optical fiber communication systems
VHS: 45h00 (Lecture: 3h00, TD: 00)
Credits: 5
Coefficient: 3

Teaching objectives:

This course provides the student with a theoretical and hands-on background in Optical Fiber Communication Systems. It will permit to obtain a familiarity with most major areas of optical communications.

Recommended prior knowledge:

Communication Systems

Material content:

- Introduction to Optical Fiber
- Optical Sources
- Optical Detectors
- Transmission Characteristics of Optical Fiber
- WDM, DWDM and CWDM Systems: Principles and Technology

Evaluation method:

Continuous assessment: 30%; Examination: 70%.

Bibliographical references:

1. L. G. Kazovsky, S. Benedetto, A. E. Willner, "Optical Fiber Communication Systems," Artech House, Jun 1996.
2. J. Gowar, "Optical Communications Systems," Prentice-Hall, London 1984.
3. G. P. Agrawal "Fiber-Optic Communication Systems," 4th Edition, Wiley, November 2010.

Semester: 3
Teaching unit: UEF 2.1.1
Material 2: Radar systems
VHS: 45h00 (Lecture: 3h00, TD: 00)
Credits: 5
Coefficient: 3

Teaching objectives:

knowledge of different types of radar systems and their corresponding signal processing,extracting targets information from signals embedded in noise and affected by interfering signals and clutters.

Recommended prior knowledge:

Basic notions of probability distributions, Energy Signals, Correlation and convolution, Signal waveforms and filtering, Fourier transform and Fast Fourier transform (FFT).

Material content:

- Introduction to radar – Basic principles -
- Detection and Estimation theory
- Some typical radars and detection processes
- False alarm and detection probabilities
- Radar targets and clutter
- Signal processing of some typical radars

Method of evaluation:

Continuous assessment: 30%; Examination: 70%.

Bibliographical references :

1. Radar Principles, NadavLevanon, John Wiley and Sons, Inc., 1988.
2. Radar Design Principles - Signal Processing and the Environment-. Fred E. Nathanson, 2nd Ed., McGraw-Hill Book Co.
3. Radar Systems Analysis and Design Using MATLAB, Bassem R. Mahafza, Chapman & Hall/CRC 2000.

Semester: 3
Teaching unit: UEF 2.1.2
Material 3: RF and Microwave Circuit Design
VHS: 45h00 (Lecture: 3h00, TD: 00)
Credits: 6
Coefficient: 3

Teaching objectives:

Knowledge to design microwave circuits based on active devices. Among these circuits, we state, narrow band microwave amplifiers, narrow band microwave oscillators and mixers. The design is based on the use of S-parameters.

Recommended prior knowledge:

- Basic understanding of RF design and analysismethods.
- Basic design theory of microwaves *circuits*

Material content:

- Use of S-Parameters with Two Port-Networks
- Narrow Band Impedance Matching with LC Networks
- Microwave Filter Design
- Microwave Amplifier Design
- Microwave Oscillator Design
- Microwave Mixer Design

Evaluation method:

Continuous assessment: 30%; Examination: 70%.

Bibliographical references:

1. Gonzalez, Guillermo, "Microwave Transistor Amplifiers: Analysis and Design", Second Edition, Prentice Hall, 1997.
2. Robert E. Collin, "Foundations of Microwave Engineering," Second Edition, John Wiley, 2007.
3. Vendelin, Pavio & Rohde "Microwave Circuit design Using Linear and Nonlinear techniques", Second Edition, John Wiley; 2005.
4. Stephen A. Maas, Nonlinear Microwave and RF Circuits, 2nd Edition, Artech House, INC., 2003

Semester:3
Teaching unit: UEF 2.1.2
Subject 4: Wireless Communications
VHS: 45h00 (Lecture: 3h00, TD: 00)
Credits: 5
Coefficient: 2

Teaching objectives:

This course will cover various concepts in modern 3G and 4G wireless communication systems such as Multiple -Input Multiple -Output (MIMO), Code Division for Multiple Access (CDMA) and Orthogonal Frequency Division Multiplexing (OFDM), beginning from the basics. The course is intended as an introductory course for Students in the areas of Communications and Signal Processing. The treatment would look at current and upcoming wireless communication technologies for broadband wireless access.

Recommended prior knowledge:

Students must have a good knowledge on Math, Statistics and Signals and Systems.

Material content:

- Introduction to 3G/4G/5G/6G Standards, Basics of Communication
- Wireless Channel, Fading and BER of Wired Communication
- BER for Wireless Communication, Introduction to Diversity
- Advanced Multi-antenna Maximal Ratio Combiner and BER with Diversity
- Spatial Diversity and Diversity Order, Wireless Channel and Delay Spread
- MIMO System Model and Zero-Forcing Receiver,MIMO MMSE Receiver
- Introduction of Wireless Propagation Models, Ground Reflection and Okumura Models, Hata Model and Log Normal Shadowing, Link Budget Analysis
- Cellular Systems

Evaluation method:

Continuous assessment: 30%;   Examination: 70%.

Bibliographical references:

[1] :K. Feher, Wireless Digital Communications, latest editions
[2] : T. Rappaport, Wireless Communications, Latest editions
[3] : J. Schiller, Mobile Communications
[4] : LeonCouch, Digital and analog communication systems, latest edition
[5] : B.P.Lathi, Analog and Digital communication systems, latest edition
[6] : J. Proakis, Digital communication systems, latest edition
[7] : D. Sharma, Course manual "Communication Systems II".

Semester: 3
Teaching unit: UEM 2.1.1
Material 1: Optical fiber communication systems Lab
VHS: 22h30 (Lecture: 3h00)
Credits: 2
Coefficient: 1

Teaching objectives:

This lab provides the student with hands-on background in Optical Fiber Communication Systems. It will permit to obtain a familiarity with most practical areas of optical communications.

Recommended prior knowledge:

Communication Systems

Material content:

Lab1: Getting Started with the Simulator
Lab2: Loss and Power Budget
Lab3: Multimode Fibers
Lab4: Dispersion in Single mode Fibers
Lab5: Laser Transmitters
Lab6: PIN Photodiode
Lab7: Optical-Amplifiers-Erbium-Doped-Fibers
Lab8: Attenuation-Limited Fiber Length
Lab9: Dispersion Compensation
Lab10: WDM Systems

Evaluation method:

Continuous assessment: 100%; Examination:

Bibliographical references:

1. L. G. Kazovsky, S. Benedetto, A. E. Willner, "Optical Fiber Communication Systems," Artech House, Jun 1996.
2. J. Gowar, "Optical Communications Systems," Prentice-Hall, London 1984.
3. G. P. Agrawal "Fiber-Optic Communication Systems," 4th Edition, Wiley,

Semester: 3
Teaching unit: UEM 2.1.1
Material 3: RF and Microwae Circuits Design Lab
VHS: 30h00 (TP: 2h00)
Credits: 2
Coefficient: 1

Teaching objectives:

This is an accompanying set of laboratory experiments to the design of RF and Microwave communication circuits' course. At the end of the course, the student should be able to design building blocs for microwave telecommunication circuits.

Recommended prior knowledge:

- Basic understanding of RF design and analysis methods.
- Basic design theory of microwaves *communications circuits*

Material content:

- Introduction to EE 541 Laboratory
- Introduction to Advanced Design System
- Matching Networks
- Stability and Gains
- Microwaves Amplifiers Design

Evaluation method:

Continuous Assessment: 100%

References

1. G. Matthaei, L. Young, and E. M. T. Jones, Microwave Filters, Impedance-Matching Nteworks, and Coupling Structures,
2. G. Gonzalez, Microwave Transistor Amplifier, Analysis and Design.
3. G. D. Vendelin, Design of Amplifiers and Oscillators by the S-Parameter Method.
4. Laboratory Manual

Semester:3
Teaching unit: UEM 2.1
Material 2: Radar Systems Lab
VHS: 30h00 (TP: 2h00)
Credits: 2
Coefficient: 1

Teaching objectives:

Translate radar system requirements into algorithms that work, Model and simulate radar signals and targets for different types of radars and under various conditions, Design of some typical radar simulators.

Recommended prior knowledge:

Radar basics; Signal waveforms; Detection and estimation theory ; Spectral analysis

Material content:

- MATLAB basics
- Computer Data generation : Waveform, clutter and noise generation
- Target detection : Radar Doppler and range estimation
- Complex target detection

Evaluation method:

Continuous assessment: 100%

References

1. Radar Principles, Nadav Levanon, John Wiley and Sons, Inc., 1988.

2. Radar Design Principles - Signal Processing and the Environment-. Fred E. Nathanson, 2nd Ed., McGraw-Hill Book Co.

3. Radar Systems Analysis and Design Using MATLAB, Bassem R. Mahafza, Chapman & Hall/CRC 2000.

Semester: 3
Transversal UE: UET 2.1.1
Subject 1: Communication skills
VHS: 22h30 (lecture: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

This is a 'service English' communication course intended to prepare the students to communicate in English (Lab reports, Industrial experience reports and end of study cycle project reports). The course outline presented in this document is divided into two parts: a first part (first five units) which is considered as a link between the students' previous work in the first two semesters; and a second part consisting of eleven units which will present the students with discourse behaviours and discourse means to communicate in English. Other items are treated throughout the program: mechanics of writing (punctuation, numbering of chapters and sub-chapters, labelling of visuals, quotations...).

Recommended prior knowledge:

Student must attend all English courses

Content of the material:

a) **Part One**
1. Transition from sentence production to the development of continuous prose,
2. Devices for linking ideas and sentences: logical, grammatical and lexical connectors,
3. Concepts of reference,
4. Paragraph Development: Producing pieces of coherent discourse,
5. Different types of paragraphs (analysis, description, comparison/contrast, analogy, definition ...)

b) **Part Two**
1. Definition: Explaining what something is, 2. Instructions and Process: Explaining how to do something, 3. Description of a Mechanism: Explaining how something works,
4. Analysis through Classification and Partition: Putting things in order, 5. Analysis through Effect and Cause: Answering Why, 6. The Summary: Abstracting and Getting to the heart of the matter, 7. Using the Library: Getting acquainted with resource materials, 8. Visuals: Seeing is convincing, 9. Report Writing: Telling it like it is, 10. Oral communication: Saying it clearly, 11. Business Letters: Sending a Message through the mail

Method of evaluation:

Review: 100%

Bibliographical references:

1. Rob Biesenbach, Unleash the Power of Storytelling: Win Hearts, Change Minds, Get Results, Eastlawn Media (February 13, 2018).
2. Carmine Gall, Five Stars: The Communication Secrets to Get from Good to Great Hardcover, St. Martin's Press (June 5, 2018)
3. Mark Goulston , Just Listen: Discover the Secret to Getting Through to Absolutely Anyone, AMACOM; Reprint edition (March 4, 2015)
4. Celeste Headlee We Need to Talk: How to Have Conversations That Matter, Harper Wave (September 19, 2017).
5. Jerold Panas and Andrew Sobel (Author), Power Questions: Build Relationships, Win New Business, and Influence Others,Wiley; 1st edition (February 7, 2012)

Semester: 3
Transversal UE : UET 2.1.1
Subject 2: Project Management
VHS: 22h30 (lecture: 1h30)
Credits: 1
Coefficient: 1

Teaching objectives:

1. Understand and apply the sequential steps of the project management framework.
2. Understand the importance and function of project management and apply the project process of initiating, planning, executing, controlling and closing the project.

Recommended prior knowledge:

Ethics&Integrity (**basics**)

Content of the material:

Chapter 1. Initiating a project

Chapter 2. Planing of project activities

Chapter 3. Project execution activities

Chapter 4. Closing down the project activities

Chapter 5. Application and case studies :

- Representing and scheduling project steps activities
- Use of software program : Primavera activities

Method of evaluation:

Review: 100%

Bibliographical references:

1. P. Lewis, Fundamentals of Project Management, James, ISBN: 9780814408797
2. [2]Harold, KerznerProject Management: A Systems Approach to Planning, Scheduling, and Controlling, (ISBN-10: 0471741876/ISBN-13: 978-0471741879).

Semester: 3
Teaching unit: UED 2.1.1
Subject1: Introduction to Machine learning and Deep learning
VHS: 30h00 (Lecture: 2:00 hours)
Credits: 1
Coefficient: 1

Teaching objectives:

After the completion of this course, the student will gain a broad understanding of the key concepts in machine learning and deep learning.

Recommended prior knowledge:

- Basic Maths courses.

Material content:

1.Introduction to Machine Learning

2.Foundations of Machine Learning

3.Supervised Learning Algorithms

4.Unsupervised Learning Algorithms

5.Introduction to Deep Learning

6.Deep Learning Architectures

7.Advanced Topics in Deep Learning

Evaluation method :

Continuous assessment: 100%.

References

1.Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow", O'Reilly Media, 2019