المواد الدراسية في تخصص ماجستير هندسة الالكترونيك والاتصالات

أ- الفصل الدراسي الأول:

ت	اسم الموضوع باللغة الإنكليزية	عدد الوحدات	عدد الساعات
1	Advanced Data Communications	2	2
2	Advanced Digital Signal Processing	2	2
3	Advanced Mathematics	2	2
4	Advanced Electronics	2	2
5	Computer Networks	2	2
6	Elective Subject I	2	2
7	English Language I	1	2
المجموع:		13	14

ب- الفصل الدراسي الثاني:

ت	اسم الموضوع باللغة الإنكليزية	عدد الوحدات	عدد الساعات
1	Mobile Communications	2	2
2	Advanced Digital Techniques	2	2
3	Advanced Power Electronics	2	2
4	Optical Communication Systems	2	2
5	Intelligent Systems	2	2
6	Elective Subject II	2	2
7	English Language II	1	1
8	Research Methodology	Satisfied	1
المجموع:		13	14

القسم: الهندسة الكهربائية الدراسة: ماجستير التخصص: الكترونيك واتصالات

اسم المقرر الدراسي: **Advanced Data Communications**

1- **Introduction (review)**: Elements of a digital commnication system, channel capacity, channel modeling, communication link power calculations, computer use in communication system for analysis and design, systems and noise, signal sampling, digital carrier systems, binay and M-ary modulation techniques.

2- **Characterization of Communication Signals and Systems** : Representation of band–pass signals and systems signal space representation, Gauussian (Normal) random variable, Chi-Square random variable, Rayleigh random variable, Ricean random, Nakagami random variable, Lognormal random variable, functions of one random variable and two random variable, limit theorems for sums of random variables, spectral charcteristic of digitally modulated signals.

3- **Optimum Receiver for AWGN Channel**: Optimum receiver for signals corrupted by AWGN, performance of optimum receiver for memory-less modulation, optimum receiver for CPM signals.

4- **Carrier and Symbol Synchronization**: Signal parameter estimation, carrier phase estimation, symbol timing estimation, joint estimation of carrier phase and symbol timing, perfoemance characteristics of ML estimators.

5- **Signal Design for bandlimited Channels**: Characterization of bandlimited channels, signals design for bandlimited channels, modulation codes for sectrum shaping.

6- **Multipath Channels**: Characterization of fading multipath channels, faded channal models, frequency selective and frequency selective and frequency nonselective channels, slow and fast fading, Rayleigh, Rician and Nakagami fading channels.

7- **Communication Through Bandlimited Channels**: Optimum receiver for channels with ISI and AWGN linear equalization, decision–feedback equalization, iterative equalization and decoding-turbo equalization.

8- **Coding Techniques**: Turbo codes, iterative decoding for Turbo codes, performance bounds for Turbo codes, Low Density Parity Check (LDPC) codes, factor graphs and the sum–product algorithm, MAP decoding.

القسم: الهندسة الكهربائية الدراسة: ماجستير التخصص: الكترونيك واتصالات

اسم المقرر الدراسي: **Advanced Digital Signal Proccessing**

1- **Application of Digital Filtering**: Speech Enhancement and Filtering, Bandpass Filtering of speech.

2- **Adaptive Filters and Applications**: Adaptive Finite Impulse Response, Filters, Basic Wiener Filer Theory and Least Mean Square Algorithm

3- **Random Digital Signals**: Measures of Random Digital Signals, Mean–Square and Variance, Random DSP

4- **2-D Signal Processing**: 2-D Linear convolution, 2-D Circular convolution, Row / Column decomposition for 2-D FFT calculations, 2-D Convolution using 2-D FFT.

5- **Image Processing**: Image Processing Notation and Data Formats, 8-Bit Gray Level Images, 24-Bit color Images, Image Level Adjustment and Image Filtering Enhancement, Image Spectra.

6- **Wavelets:** Wavelet Families

القسم: الهندسة الكهربائية الدراسة: ماجستير التخصص: الكترونيك واتصالات

اسم المقرر الدراسي: **Advanced Mathematics**

1- Matrix theory

2- Vector space, subspace, linear dependence and linear independence

3- Span, basis of a vector space

4- Basis and coordinates, changes of basis, linear transformation, successive linear transformation

5- Inner product of vectors, orthogonal vectors, vector norm, matric norm, orthogonalization process (Gram- Schmidt process)

6- Hermitian and Hermitian matrix, orthogonal matrix and orthogonal transformation, unitary matric and transformation

7- Characteristic equation of a matrix, Cayley Hamilton theorem, Diagonalization of a square matrix.

8- Bilinear, Hermitian and quadratic forms. Transformation of quadratic forms to principal axes.

9- Polynomial of square matrix, matrix equations

10- Solution of a set of simultaneous ordinary differential equations with constant coefficients.

11- Fourier and correlation matrices and their applications.

12- Optimization, unconstrained optimization, constraint optimization-Lagrange multiplier, optimization of linear models, graphical solution, simplex method,

13- Tabular and dual methods

القسم: الهندسة الكهربائية

اسم المقرر الدراسي: **Mobile Communications** الدراسة: ماجستير التخصص: الكترونيك واتصالات

- Introduction, wireless and cellular environments, wireless propagation channel, Legacy systems and brief introduction to AMPS and TACS,
- Modulation and coding for wireless systems, Modulation techniques (analogue and digital, BPSK, QPSK and QAM, OFDM), Multiple access techniques (TDMA, FDMA and CDMA), Coding (error control and source coding),
- GSM: System architecture, Physical layer, Logical and physical channels, Data and services, 2.5 G Basics (HSCSD, GPRS, EDGE, EGPRS),
- UMTS: System architecture, The physical layer, Coding and channel allocation, Network design, 3.5 and 3.75 systems (HSDPA, HSUPA and HSPA),
- 4^{th} generation systems and LTE: System architecture and evolved packet core, physical layer, Beyond 4G,
- Other aspects and technologies: Mobile networks implementation and planning, Mobile services and business aspects,
- RF Safety, Mobile industry, commercial and financial aspects and on recent/future developments.
- Mobile Channels Modeling and allocation
- Interference Analysis and Reduction Techniques

القسم: الهندسة الكهربائية الدراسة: ماجستير التخصص: الكترونيك واتصالات

اسم المقرر الدراسي: **Computer Networks**

1- Computer Networks and the Internet,

2- Application Layer: Principles of Network Operation, HTTP, FTP, DNS, P2P, Socket Programming,

3- Transport Layer: Multiplexing and Demultiplexing, UDP, Principles of reliable Connection, TCP, TCP Congestion Control,

4- Network Layer: IP Protocol, Routing Algorithms, RIP, OSPF, MPLS, BGP,

5- Link Layer: Error Detection and Correction,

6- Multiple Access Links and Protocol, Switched Local Networks, link Virtualization, Data Center Switching, Wireless and Mobile Networking: WiFi 802.11 wireless LANs, Cellular Internet Access, Management, IP Mobility Antenna and microwave Planning,

7- Multimedia Networking: Application, Streaming Stored Media, VoIP, Protocols, Network Support, Congestion Control,

8- Network Measurements, Packet Monitoring, Flow Monitoring,

9- Software defined Network, Control /Data Plane separation, Programming SDN,

10- Traffic Engineering: Interdomain, Control Loop, optimization, Multipath, Data Center: Networking Challenges, Topologies, Traffic Engineering, Jellyfish,

11- Hands On: Wireshark, SDN Python Programming, Mininet, GNS3.

القسم: الهندسة الكهربائية

الدراسة: ماجستير التخصص: الكترونيك واتصالات

اسم المقرر الدراسي: **Optical Commuincation Systems**

- Topics:
  1- Principles of Optical Fiber Communications
  2- Optical Fiber: Structure, Wave guiding,
  3- Signal Degradation in Optical Fibers
  4- Optical Sources
  5- Power Launching and Coupling
  6- Photodetectors
  7- Optical Receiver Operation

- Modules

  Module_1: Basic History, Evolution of Fiber Optic Systems, Elements of an Optical Fiber Transmission Link, characteristics of Light, Polarization.

  Module 2: Nature of light and ray theory, Optical Lays and Definitions, Optical Fiber Modes and Configuration of phenomenon of total internal reflection, Mode Propagation of Light rays in an Optical fiber. Annular rings of Different modes

  Module 3: Single –Mode Fiber, Graded- Index Fiber structure, Fiber Materials, Fiber Fabrication, Mechanical Properties of Fiber Optic Cables

  Module4: Signal Distortion in Optical Waveguides, Pulse Broadening in (the dispersion), material dispersion, waveguide dispersion, Chromatic Dispersion, Attenuation, Rayleigh Scattering in Optical Fiber, Micro and macro bending loss, Mode field diameters, Design Optimization of Single-Mode Fibers. DS and DF fiber, birefringence.

  Module 5: Topics from Semiconductor Physics, Light-Emitting Diodes (LEDs), LED efficiency, Stimulated and Spontaneous Emission, population inversion, laser Diodes, System of more than two energy levels, Fabray -Perot Cavity, Modal, DFB LASER, and LASER Noise.

  Module 6: Output characteristics of LASER diode, The modulating frequency of the LASER diode, Comparative study between LED and ASER Practical aspects and measurements, Fiber – to Fiber Joints, LED Coupling to Single –Mode Fiber Splicing, optical Fiber Connectors,

  Module 7: Physical Principles of Photodiodes, Photodetector Noise, Detector Response Time, Avalanche Multiplication Noise, Comparison of Photodetectors.

  Module 8: Fundamental Receiver Operation, Digital Receiver Performance, Analog receivers.

القسم: الهندسة الكهربائية

اسم المقرر الدراسي: Intelligent Systems

الدراسة: ماجستير

التخصص: الكترونيك واتصالات

1- Introduction to Intelligent Systems

2- Artificial Neural Networks: Concept and activation functions, types of neural networks including generalized delta rule, ADALINE, Multi-level Perceptron, Recurrent Neural Networks, Self-orginizing maps and Adaptive Resonance Theory

3- Machine Learning and Deep Nueral Networks

4- Pattern Classification

5- Genetic Algorithms: Chromosomes encoding, fitness evaluation, search stratigies and beeding selection, crossover, mutation and replacement.

6- Reasoning: Goal Trees and Problem Solving

7- Probabilistic Inference

8- Rule Based Systems

9- Fuzzy Sets Theory

10- Fuzzy Systems and fuzzy logic controllers: Fuzzification, Fuzzy knowledge based and defuzzification

11- Multi-agent sytems

12- Hybrid systems

القسم: الهندسة الكهربائية الدراسة: ماجستير التخصص: الكترونيك واتصالات

اسم المقرر الدراسي: **Advanced Electronics**

1- Overview of semiconductor application, silicon integrated circuit technology, behavior of passive components, chip components and circuit board considerations, Review of transmission lines, Impedance and admittance transformation, Parallel and series connection of networks

2- Single stage amplifiers, two port small signal model, common source amplifier with resistor and current source supply, common base/gate amplifier, common collector/drain, review frequency domain analysis, current gain frequency response of common emitter amplifier, voltage gain frequency response of common emitter amplifier , full analysis of common emitter, the Miller approximation, Open circuit time constant analysis, common-gate and common-drain amplifiers, multistage amplifiers, cascading small signal two port models, DC coupling voltage sources, MOS current sources and sinks Analyzing complex circuits. Analysis of amplifier using scattering parameter, Instrumentation and Isolation Amplifiers, Operational Amplifier-Bipolar Transistor Logarithmic Amplifier

3- RF Transistor Amplifier Design, Impedance matching using discrete components. Microstrip line matching networks. Amplifier classes of operation and biasing networks-Amplifier power gain, Unilateral design Simple input and output matching networks-Bilateral design, Stability circle and conditional stability, Simultaneous conjugate matching for unconditionally stable transistors. Broadband amplifiers, High power amplifiers and multistage amplifiers, RF filters basic resonator and filter configurations, Butterworth and Chebyshev filters, Implementation of microstrip filter design, Band pass filter and cascading of band pass filter elements.

4- Design of Data Acquisition Systems, Amplification of Low-level signals, Grounding, Shielding and Guarding techniques, Dual slope, quad slope and high-speed A/D converters, Sample and Hold, Microprocessors Compatible A/D converters, Multiplying A/D converters and Logarithmic A/D converters, Integrating voltage-to-time conversion A/D converters, Sigma delta A/D converters, Flash A/D converters, Design of two and four wire transmitters, Log-Antilog Circuit Application.

5- Design of Printed Circuit (PCB) Boards: Introduction to technology of PCB, General lay out and rules and parameters, PCB design rules for Digital, High Frequency, Analog, Power Electronics and Microwave circuits, Computer Aided design of PCBs.

اسم المقرر الدراسي: **Advanced Power Electronics**

1- **DC-DC Converters**: Principles of step-down operation, methods for varying duty cycle, generation of duty cycle, step-down converter with RL load, step-down buck converter (continuous conduction mode, boundary between continuous and discontinuous conduction, discontinuous conduction mode, output voltage ripple), step-up Boost converter (continuous-conduction mode, discontinuous-conduction mode, output voltage ripple, Buck-Boost Converter (continuous–conduction mode, boundary between continuous and discontinuous conduction mode, output voltage mode, output voltage ripple), Cuk DC-DC Converter, SEPIC Converter, Full Bridge DC-DC Converter (PWM with Bipolar voltage switching, PWM with Unipolar voltage switching).

2- **Switching DC Power Supplies**: Flyback Converter, Forward Converter, Push-Pull Converter, Half-Bridge Converter, Full-Bridge Converter, Current source DC-DC Converter.

3- **Switch-Mode DC-AC Inverters**: Basic concepts of switch-mode inverters, Pulse-width-modulated switching scheme, square wave switching scheme, single phase inverters PWM with bipolar voltage switching, PWM with unipolar voltages witching, Quasi-square wave output inverters, ripple in the single-phase inverter output, Push-PulI inverters, three-phase inverter (PWM three phase inverter, square wave operation in three phase inverter, ripple in the inverter output), effect of blanking time on voltage in PWM Inverters, programmable harmonic elimination switching (bipolar output voltage notches, unipolar output voltage notches), current source inverters (single phase current source inverter, three-phase current source inverter, current source inverter with PWM), inverter circuit design.

4- **AC Voltage controller**: On-Off control, phase control (unidirectional controller, single-phase bidirectional controllers with resistive load, single-phase full-wave controller with common cathode, single-phase full-wave controller with inductive load, single-phase transformer connection changer, AC Voltage controllers with PWM Control, single-phase cycloconverters.

5- **Resonant Converters**: Advantages of resonant converters over PWM converters, Series and parallel resonant converters, half bridge operation, discontinuous and continuous current modes, principles of zero voltage and zero current switching control.

القسم: الهندسة الكهربائية الدراسة: ماجستير التخصص: الكترونيك واتصالات

اسم المقرر الدراسي: Advanced Digital Techniques

1- **Sequential Circuits:** Design of synchronous sequential circuits, design of asynchronous sequential circuits, Algorithmic State Machine (ASM), digital system synthesis using ASM.

2- **Programmable Devices:** Device programming technologies, simple programmable devices, PAL and PLA, complex programmable devices, Field Programmable Gate Arrays (FPGA) technology.

3- **Field Programmable Gate Arrays:** FPGA types, PGA architecture, logic blocks, routing strategies, FPGA design flow, hardware description languages, programming with VHDL language, selected applications for FPGA technology.

القسم: الهندسة الكهربائية الدراسة: ماجستير التخصص: الكترونيك واتصالات

اسم المقرر الدراسي: Cloud Computing

1- Cloud system architectures

2- Service models (infrastructure/platform/software)

3- Big data storage and management

4- Cloud programming frameworks

5- Virtualization and resource management

6- Security, privacy, lock-in, and other risks (and mitigations) for individuals and companies.

7- Data center networks

8- Energy use in data centers

Course Title: Research Methodology

Topics:

- Introduction to Research Methodology
- Types of Research Methods Including Experimental, Simulation, Analytical and Empirical Methods
- Literature Review and Its Role in Conducting Effective Research
- Sources of Literature, Literature Review Process, and Critical Analysis of Literature
- Identification of Research Problem, Formulating Research Questions and Hypothesis, and Developing Research Objectives
- Research Experiments Planning and Design Including Data Collection and Sampling methods and techniques.
- Academic Writing in Engineering and Research Report Writing
- Structure and Format of a Scientific Research Report, Citation Management Tools, and Referencing Style
- Technical Writing Skills and Strategies
- Effective Research Presentation
- Case Studies and Project Presentation

References:

1. C. George Thomas. (2021), Research Methodology and Scientific Writing, 2nd Ed., Springer.

2. C. R. Kothari and Gaurav Garg. (2019), Research Methodology: Methods and Techniques, Fourth edition, New Age International Publishers.

3. B. Samanta and Debabrata, M. Hammoudeh, N.. Chilamkurti, H. Islam (2022) Data Analytics, Computational Statistics, and Operations Research for Engineers: Methodologies and Applications, CRC Press.