ARAB ACADEMY FOR SCIENCE, TECHNOLOGY
AND MARITIME TRANSPORT

COLLEGE OF ENGINEERING
AND TECHNOLOGY

(GRADUATE STUDIES)

Master of Science Programs

STATUS REPORT

ALEXANDRIA

2012

ELECTRONICS AND COMMUNICATIONS ENGINEERING

M.SC. PROGRAMS

M.Sc. in Electronics and Communications Engineering

OVERVIEW

Established in 1987, the department is considered to be the first Electronics and Communications Engineering Department all over Non-State universities in Egypt, with its primary mission to cope with the rapid progress in the area of electronics and communications which has been reflected on all aspects of life and led to a new era of advanced technology.

This mandates the creation of national specialists capable of coping with the future advancement in this area, and contributing positively to the solution of problems hindering the optimum use of such technologies in different applications.

The objectives of the Electronics and Communications Engineering Department are:

- To teach students how to analyze and implement interdisciplinary engineering projects.
- To prepare the students for competitive and challenging industrial applications in the areas of Wireless Communications, Biomedical Engineering, Analog and Digital Signal Processing Systems, Computer Controlled Automated Industrial Systems, Mobile Communication Systems, Microcontrollers and Embedded Systems, Antennas and Microwave Systems.
- To give students a strong foundation for graduate studies in the field of Electronics and Communications Engineering.
- To teach students how to use state-of-the-art computer aided design tools for solving electronics and communications engineering problems.
- To expose students to hands-on engineering experience through laboratory sessions, design and research projects.
- To cultivate the ability of the students to communicate and work effectively in teams.
- To help students develop an understanding of the ethical issues arising in the practice of the engineering profession.

In order to accomplish the aforementioned objectives, the Electronics and Communications Engineering program offers the following graduate degrees:

- M. Sc. in Electronics and Communications Engineering.
- Diploma in one of the following areas:
    - Advanced Communications Engineering
    - Microelectronics
    - Biomedical Engineering

The program of study towards the M.Sc. Degree aims at providing the student with scientific and technical background necessary for the electronics and communications engineer. This includes mathematics, physics, electrical engineering, and computer science, in addition to a great depth of knowledge of the generation, transmission, and radiation of electronic signals, and the design of electronic systems.

M.Sc. in Electronics and Communications Engineering

Job opportunities for the graduate of the electronic and communications engineering program cover a whole spectrum of fields including civilian and military applications, concerned with specifying the most suitable equipment for a certain function, offering expert opinion and consultation in the field, designing electronics and communications systems, equipments, and circuits.

Application areas include consumer electronics, fixed and mobile telephony systems, biomedical systems, electronic computers, Radio and television, GPS, radar systems, and satellite communications systems.

Program Detailed Structure

M.Sc. Programs

M.Sc. in Electronics and Communications Engineering

Division (A): Electronics Engineering

Core Courses:

Course Code	Course Title	Credit Hours
EC 721	Advanced Digital Communications	3
EC 731	Advanced Digital Signal Processing	3
EC 732	Automated Measurements	3
Subtotal	**3 Courses * 3 Credit Hours**	**9**

Division (B): Communications Engineering

Core Courses:

Course Code	Course Title	Credit Hours
EC 721	Advanced Digital Communications	3
EC 731	Advanced Digital Signal Processing	3
EC 742	Microwave Antennas Systems	3
Subtotal	**3 Courses * 3 Credit Hours**	**9**

Divisions (A) and (B)

Elective Courses:

Course Code	Course Title	Credit Hours
EC 713	Biomedical Engineering	3
EC 720	Modern Techniques in Pattern Recognition	3
EC 722	Optical Communications	3
EC 723	Satellite Communication Systems	3
EC 724	Mobile and Spread Spectrum Communications	3
EC 725	Speech Signal Processing and Digital Telephony	3
EC 726	Adaptive Signal Processing	3
EC 727	Communications Intelligence	3
EC 728	Communication Seminar	3
EC 729	Applications of SAW and CCD in Communication Systems	3

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Course Code	Course Title	Credit Hours
EC 730	Audio and Video Compression	3
EC 733	Photonic Devices	3
EC 734	Non-Silicon Semiconductors	3
EC 735	Electronics Seminar	3
EC 736	Neural Networks Applications	3
EC 737	Advanced Digital VLSI Design and Testing	3
EC 738	Advanced Electronic Devices	3
EC 739	Analog VLSI Design	3
EC 742	Microwave Antennas Systems	3
EC 743	Antennas for Mobile Communications	3
EC 744	Wireless Communications	3
EC 745	Telecommunication Networks	3
EC 746	Mobile Data Management	3
EC 747	Advanced Digital Image Processing	3
EC 748	Multimedia Communications Systems	3
EC 749	Computer-Aided Design and Analysis of Communication Systems	3
Elective Subtotal	**5 Courses * 3 Credit Hours**	**15**

RESEARCH THESIS:

Course Code	Course Title	Credit Hours
EC 701	Master's Research Thesis (Part 1)	6
EC 702	Master's Research Thesis (Part 2)	6
Subtotal	**2 Parts * 6 Credit Hours**	**12**

Total	**36**

M.Sc. in Electronics and Communications Engineering
Division (C): Biomedical Engineering

Core Courses:

Course Code	Course Title	Credit Hours
BE 711	Introduction to Biomedical Engineering	3
BE 712	Elementary Human Anatomy	3
BE 713	Elementary Human Physiology	3
Subtotal	**3 Courses * 3 Credit Hours**	**9**

Elective Courses:

Course Code	Course Title	Credit Hours
BE 715	Biological Systems Modeling and Analysis	3
BE 716	Biomedical Measurements	3
BE 717	Medical Imaging	3
BE 718	Biomedical Signal Processing	3
BE 719	Statistics for Biomedical Engineering	3
BE 720	Magnetic Resonance Imaging	3
BE 721	Biosensors	3
BE 722	Biomedical Seminar	3
BE 723	Neural Networks	3
BE 724	Advanced Patient Monitoring and Safety	3
BE 725	Telemedicine Networks	3
BE 726	Special Topics in Biomedical Engineering	3
Subtotal	**5 Courses * 3 Credit Hours**	**15**

Research Thesis:

Course Code	Course Title	Credit Hours
EC 701	Master's Research Thesis (Part 1)	6
EC 702	Master's Research Thesis (Part 2)	6
Subtotal	**2 Parts * 6 Credit Hours**	**12**

Total	**36**

M.Sc. in Electronics and Communications Engineering

For Division (I) or Division (II)

The student is required to take a total of 4 core courses from either Division (I) or (II) and a total of 4 elective courses, two of them should be in his main area of research (from either group A or B).

For Division (III)

The student is required to take a total of 3 core courses from Division (III) and at least 3 elective courses from group C and the rest of the courses from groups A and B.

Division (I): Electronics Engineering

Core Courses:

Course Code	Course Title	Credit Hours
EC 760	Advanced Engineering Mathematics	3
EC 737	Advanced Digital VLSI Design and Testing	3
EC 738	Advanced Electronic Devices	3
EC 752	Advanced Analog & RF Integrated Circuits	3
Subtotal	**4 Courses * 3 Credit Hours**	**12**

Division (II): Communications Engineering

Core Courses:

Course Code	Course Title	Credit Hours
EC 760	Advanced Engineering Mathematics	3
EC 721	Advanced Digital Communications	3
EC 731	Advanced Digital Signal Processing	3
EC 742	Microwave Antennas Systems	3
Subtotal	**4 Courses * 3 Credit Hours**	**12**

Elective Courses: Group (A) - Electronics Engineering

Course Code	Course Title	Credit Hours
EC 713	Biomedical Engineering	3
EC 729	Applications of SAW and CCD in Communication Systems	3
EC 732	Automated Measurements	3
EC 733	Photonic Devices	3
EC 734	Non-Silicon Semiconductors	3
EC 735	Advanced Topics in Electronics	3
EC 736	Neural Networks Applications	3
EC 737	Advanced Digital VLSI Design and Testing	3
EC 738	Advanced Electronic Devices	3
EC 739	Analog VLSI Design	3
EC 740	Computer Aided Design for Electronic Circuits	3
EC 741	Advanced Topics in MEMS	3
EC 749	Computer-Aided Design of Communication Systems	3
EC 752	Advanced Analog & RF Integrated Circuits	3
EC 753	Nanoelectronics	3
EC 720	Modern Techniques in Pattern Recognition	3
EC 726	Adaptive Signal Processing	3
EC 730	Audio and Video Compression	3
EC 736	Neural Networks Applications	3
EC 747	Advanced Digital Image Processing	3
Courses from Other Departments		
CC 714	Computer Security	3
CC 733	Analysis and Design of Computer Networks	3
CC 752	Systems Science and Engineering	3
EE 749	Renewable Energy Systems	3

Elective Courses: Group (B) - Communications Engineering

Course Code	Course Title	Credit Hours
EC 713	Biomedical Engineering	3
EC 721	Advanced Digital Communications	3

EC 722	Optical Communications	3
EC 723	Satellite Communication Systems	3
EC 724	Mobile and Spread Spectrum Communications	3
EC 725	Speech Signal Processing and Digital Telephony	3
EC 726	Adaptive Signal Processing	3
EC 727	Communications Intelligence	3
EC 728	Communication Seminar	3
EC 729	Applications of SAW and CCD in Communication Systems	3
EC 744	Wireless Communications	3
EC 745	Telecommunication Networks	3
EC 746	Mobile Data Management	3
EC 748	Multimedia Communications Systems	3
EC 742	Microwave Antennas Systems	3
EC 743	Antennas for Mobile Communications	3
EC 750	Smart Antenna Technology	3
EC 751	Computational Electromagnetics using FD Methods	3
Courses from Other Departments		
CC 714	Computer Security	3
CC 733	Analysis and Design of Computer Networks	3
CC 752	Systems Science and Engineering	3
EE 749	Renewable Energy Systems	3

Research Thesis:

Course Code	Course Title	Credit Hours
EC 701	Master's Research Thesis (Part 1)	6
EC 702	Master's Research Thesis (Part 2)	6
Subtotal	**2 Parts * 6 Credit Hours**	**12**
Subtotal	**4 core courses * 3 Credit Hours**	**12**
Subtotal	**4 elective courses * 3 Credit Hours**	**12**
Total		**36**

Division (III): Biomedical Engineering

Core Courses:

Course Code	Course Title	Credit Hours
BE 711	Introduction to Biomedical Engineering	3
BE 712	Elementary Human Anatomy	3
BE 713	Elementary Human Physiology	3
Subtotal	**3 Courses * 3 Credit Hours**	**9**

Elective Courses: Group (C) - Biomedical Engineering

Course Code	Course Title	Credit Hours
BE 715	Biological Systems Modeling and Analysis	3
BE 716	Biomedical Measurements	3
BE 717	Medical Imaging	3
BE 718	Biomedical Signal Processing	3
BE 719	Statistics for Biomedical Engineering	3
BE 720	Magnetic Resonance Imaging	3
BE 721	Biosensors	3
BE 722	Biomedical Seminar	3
BE 723	Neural Networks	3
BE 724	Advanced Patient Monitoring and Safety	3
BE 725	Telemedicine Networks	3
BE 726	Special Topics in Biomedical Engineering	3
Subtotal	**5 Courses * 3 Credit Hours**	**15**

Research Thesis:

Course Code	Course Title	Credit Hours
EC 701	Master's Research Thesis (Part 1)	6
EC 702	Master's Research Thesis (Part 2)	6
Subtotal	**2 Parts * 6 Credit Hours**	**12**
Subtotal	**3 core courses * 3 Credit Hours**	**9**
Subtotal	**5 elective courses * 3 Credit Hours**	**15**
Total		**36**

Courses

DETAILED STRUCTURE

Course Code : **EC 713**
Course Title : **Biomedical Engineering**

Credit Hours : **3**

Course Description

Biomedical electronics in patient-care medical support equipment. Student projects in biomedical research topics include biomedical sensors, electromyography, biomagnetism, defibrillators, electromyography devices, biomedical lasers, biomedical signal analysis, computer tomography, nuclear medicine, ultrasound, and magnetic resonance imaging.

Course Objectives

The students should be able to apply their knowledge in electronics and communications into the analysis and design of patient-care biomedical equipment.

Course Topics

- Biomedical electronics in patient-care medical support equipment
- Biomedical sensors
- Electromyography
- Biomagnetism
- Defibrillators
- Electromyography devices
- Biomedical lasers
- Biomedical signal analysis
- Computer tomography
- Nuclear medicine
- Ultrasound
- Magnetic resonance imaging

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Explain the operation of pacemakers.
- Know historical considerations in biomedical instrumentations
- Know the basic laws for biological currents and voltages
- Describe depolarization of living cells,
- Know Goldmann's equation, and Nernst equation
- Examine bio potentials of the heart.
- Describe electrode charge distributions
- Explain the temperature transducers
- Show how Strain Gauges are used as transducers to measure blood volume
- Explain how differential capacitors are used to measure tissue displacement
- Know the theory of operation of the differential amplifier.
- Explain the operation of ECG equipment
- Describe the placement positions of ECG electrodes on the human body
- Identify the augmented ECG lead connection and the chest ECG lead connections.
- Explain the operation of EEG equipment
- Describe the placement positions of EEG electrodes on skull.
- Explain the function of pacemakers.
- Calculate the life time of the pacemaker battery.
- Generalize the basics and the concepts of Biomedical Engineering.
- Explain laws of diffusion , drift equations and Einstein's relationship
- Estimate biological currents in the human body.
- Estimate bio potentials in the heart.
- Estimate electrode impedance.
- Describe semiconductor and conductor thermistors
- Estimate the common mode rejection of the operational amplifiers.
- Explain common mode voltage reduction circuits.
- Describe the construction of differential amplifiers using Op-Amps
- Calculate potential difference from ECG equipment
- Calculate potential difference from EEG equipment

Intellectual Skills

- Calculate the life time of the pacemaker battery.
- Generalize the basics and the concepts of Biomedical Engineering.
- Explain laws of diffusion , drift equations and Einstein's relationship
- Estimate biological currents in the human body.
- Estimate bio potentials in the heart.
- Estimate electrode impedance.
- Describe semiconductor and conductor thermistors
- Estimate the common mode rejection of the operational amplifiers.
- Explain common mode voltage reduction circuits.
- Describe the construction of differential amplifiers using Op-Amps
- Calculate potential difference from ECG equipment
- Calculate potential difference from EEG equipment

Professional Skills

- Design electronic circuits that serves as a base for biomedical equipments
- Differentiate between the diffusion current and the drift current.
- Analyze an example of two ion currents"
- Distinguish basic laws of biological phenomena.
- Analyzing the human tissue
- Analyze electrode charge distribution
- Design a thermal transducer using a thermistor
- Design a Wheatstone bridge embedded with a strain gauge wire to measure the blood volume
- Design of Wheatstone bridge embedded with differential capacitors to measure tissue displacement
- Differentiate between bio potentials amplifiers, differential amplifiers, and operational amplifiers.
- Distinguish between the operation of as table and mono stable multivibrators.
- Analyze differential amplifiers, and operational amplifiers circuits.
- Analyze potential differences in ECG waveforms.
- Analyze potential differences in EEG waveforms.
- Differentiate between the EEG frequency bands, Active low pass filters for delta bands, Active high pass filters for beta bands, Active band pass filters for theta and alpha bands, Active notch filters for common mode reduction
- Analysis and design different pacemaker circuits

General Skills

- Comply with safety rules and protective measures used in bio instruments
- Propose block diagrams for medical instruments.
- Sketch the chronological chart of medical imaging
- Sketch the equivalent circuits of tissue electrode interface
- Sketch the equivalent circuit of Wheatstone bridge embedded within a thermistor
- Sketch the equivalent circuit of a wheatstone bridge embedded with strain gauge silicon wire
- Sketch the equivalent circuit of Wheatstone bridge embedded with differential capacitor
- Propose an amplifier that serves as a base for biomedical equipments.
- Sketch the ECG equipment block diagram
- Label the normal ECG, and EEG waveforms
- Estimate the pacemaker output waveforms.

Course Content

- Introduction" Overview of course contents, Overview of text book and references, Definition of medical instruments, Historical consideration".
- Biological Currents "Law of diffusion, Drift equation, Einstein relationship, Examples of two ion currents".
- Biological Currents "Goldmann's equation, Nernst equation, Tissue equivalent circuit, Depolarization of living cells, Bio potentials in the heart, Electrocardiograms".
- Biological Currents, Electrode charge distributions, Electrode equivalent circuit, Electrode impedance measurement.
- Thermal transducer "Semiconductor Thermistor, Whetstone bridge circuits, Conductor Thermistor".
- Strain Gauges, Blood volume measurement, Strain gauge silicon wire".
- Differential Capacitive Transducer "Tissue displacement measurement, Capacitor in bridge circuits".
- Bio potential Amplifiers "Potential difference in ECG and EEG equipment, Transistor differential amplifiers, Operational amplifier analysis, Bio potential measurement interference, Equivalent circuits for power line interference, Common mode Rejection Ratio, Numerical examples".
- Common mode Voltage Reduction" Electrocardiographs, Analysis of common mode Reduction circuits, Numerical examples, ECG block diagrams.
- ECG Lead connection "Standard ECG lead connections, Block diagram for standard ECG, Numerical examples, Augmented ECG lead connection, Chest ECG lead connections".

- Electroencephalographs “Placement of electrodes on skull, EEG electrodes, EEG block diagrams, EEG voltage measurements, Operational amplifier requirements”.
- EEG Active filters “EEG frequency bands, Active low pass filters for delta bands, Active high pass filters for beta bands, Active band pass filters for theta and alpha bands, Active notch filters for common mode reduction, Second written examination”.
- Pacemakers “Pacemaker block diagram, Pacemaker pulse output, Computation of battery life time, Implantable pacemakers”.
- Electronic Pacemaker circuits.

Teaching and Learning Methods

- Seminars
- Lectures
- Tutorials
- Reports & sheets
- Laboratories

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the

disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.

- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Academic Support:

- Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
- Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment

Procedures used:

1. Written Examinations
2. Oral Examinations
3. Practical Examinations
4. Class Activities (Assignments, etc ------)
5. Final Examination

Schedule:

Assessment 1 (7th and 12th Week Written Exam)

Assessment 2 (7th and 12th Week oral Exam)

Assessment 3 (7th and 12th Week practical Exam)

Assessment 4 (continuous assessment)

Assessment 5 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

References

- J. D. Branzino, *The Biomedical Engineering Handbook*, CRC and IEEE Press, 2000.
- R. Khandpur, *Handbook of Biomedical Instrumentation*, McGraw-Hill, 1995.

Course Code : **EC 760**

Course Title : **Advanced Engineering Mathematics**

Credit Hours : **3**

Course Description

The course provides graduate students with advanced methods in mathematics and their applicability in the field of electronics, communications, signal processing, antenna and wave propagation

Course Objectives

The course has the objective of letting graduate students become acquainted with advanced mathematical techniques and increase the analytical and numerical skills of graduate students.

Course Topics

- The Finite Difference Method (FDM)
- Charge Simulation Method (CSM).
- Boundary Element Method (BEM).
- Quantum Transport theory and differential difference equations.
- Random Vectors and Estimation theory , tests of hypotheses, and linear models.
- Markov chains, branching processes, Brownian motion, and stochastic integrals, simple and multiple linear regression.
- Complex differentiability, Cauchy-Riemann differential equations, contour integration, residue calculus, harmonic functions, and geometric properties of complex mappings.
- Numerical solution of boundary value problems for ordinary differential equations, integer interpolation method, numerical method for system of linear algebraic equations.
- Elements of a Game and Payoffs Games, Risk Sharing, Strategies, Sequential Move Games, Simultaneous Move Games, Nash Theory, Incomplete Information Games.

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Know the basic concept of:
- Matrix algebra
- Eigen values and Eigenvectors
- Understand rules of vector integrals
- List different numerical techniques
- Know and understand phase space concept
- List methods of data analysis
- Know random vectors and estimation theory
- Define quantum and ballistic transport mechanisms
- Describe ballistic transport

Intellectual Skills

- Apply normal and Jordan forms
- Solve problems related to vector integrals
- Apply numerical Algorithms to solve a system of linear algebraic equations, linear system of differential equations , and nonlinear differential equations
- Show qualitative behavior associated with each equilibrium point
- Apply regions of application of conformal mapping and complex integration
- Select suitable optimization technique for a given problem
- Classify regression techniques
- Apply Markov chains and hidden Markov models
- Apply Monte-Carlo Simulation to solving Schrodinger equations

Professional Skills

- Analyze solutions of systems of linear algebraic equations, system of linear differential equations, and systems of nonlinear differential equations.
- Perform numerical solutions using standard packages.
- Manipulate conformal mapping and complex integration
- Manipulate with hidden Markov models.

General Skills

- Practice the use of integral theorems in communications

- Estimate the sources of errors, step size convergence of solutions
- Practice the linear, nonlinear and integer programming
- Practice suitable optimization techniques
- Practice with the hidden Markov models
- Practice Monte-Crlo simulation

Course Content

- Linear algebra, Vector calculus
- Matrix Algebra: Matrix Eigenvalue Problems
- Vector Integral Calculus. Integral Theorems
- Non-linear Differential Equations
- Systems of Differential Equations, Phase Plane,
- Qualitative Methods, Volterra
- series, Harmonic balance
- Complex analysis
- Conformal Mapping
- Complex Integration
- Numerical Methods
- Numerical Methods in Linear Algebra
- Numerical Methods for Differential Equations
- Optimization
- Basic methods and techniques for solving optimization problems
- N-dimensional geometry and convex sets
- Classical and search optimization of functions of one and several variables
- (Linear programming, Nonlinear programming, Integer programming).
- Probability and statistics
- Data analysis
- Probability theory
- Random vector and estimation theory, tests of hypotheses, and linear models.
- Markov chains, branching processes, Brownian motion, stochastic integrals, simple and multiple linear regression
- Mathematical statistics
- Monte-Carlo simulation
- Quantum Transport theory

Teaching and Learning Methods

- Seminars
- Lectures
- Reports & sheets

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Student Assessment

Procedures used:

1- Written exams
2- Oral exams
3- Practical exams
4- Class activities
5- Final

Schedule:

Assessment 1 (7th and 12th Week Written Exam)
Assessment 2 (7th and 12th Week oral Exam)
Assessment 3 (7th and 12th Week oral Exam)
Assessment 4 (continuous assessment)
Assessment 5 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

References

- Applied game theory and strategic behavior, Patrick Anderson, 2010, CRC press,
- L.L.Ascher and L.Petzold "Computer methods for ordinary differential equations and differential algebraic equations", SIAM.
- Computational Partial Differential Equations Using MATLAB (Chapman & Hall/CRC Applied Mathematics & Nonlinear Science.
- Advanced Engineering Mathematics, 9th Edition, <http://eu.wiley.com/WileyCDA/Section/id 302479.html?query=Erwin+Kreyszig> Erwin Kreyszig , WILEY.

Course Code : **EC 720**
Course Title : **Modern Techniques in Pattern Recognition**

Credit Hours : **3**

Course Description

Features extraction techniques, classifiers, speech speaker recognition, image recognition.

Course Objectives

To become acquainted with all pattern recognition techniques.

Course Topics

- Features extraction
- Bayesian decision: Theory and traditional classifiers
- Neural Network classifiers
- Speech/speaker recognition and hidden Markov Models
- Image recognition

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Define pattern
- Identify the basic building blocks of a typical pattern recognition system
- Describe pattern recognition approaches
- Explain patter preprocessing
- Define feature extraction techniques
- Describe feature selection methodologies
- Describe the idea behind classifications
- Identify the difference between supervised and unsupervised learning
- Define what is meant by post-processing in a pattern recognition system.
- Define classifiers of biometric recognition techniques

Intellectual Skills

- Demonstrate the steps of pattern recognition
- Apply pattern recognition approaches in different problem domains
- Apply different preprocessing techniques to a given pattern
- Examine the robustness of the selected features
- Demonstrate some of the state of the art classification techniques
- Apply machine learning techniques to a given data sequence
- Select suitable classifier to a specific biometric technique

Professional Skills

- Analyze the outputs of various patter approaches and compare between them according to the application
- Analyze the extracted features
- Compare between different feature extraction techniques
- Evaluate classification techniques.
- Compare between supervised and unsupervised learning
- Analyze different post-processing
- Compare between classifiers

General Skills

- Practice different pattern recognition steps.
- Verify the output of pattern preprocessing
- Practice design of feature extraction and selection criteria
- Verify the results of an classifier.
- Verify the classifier outputs.

Course Content

- Introduction to pattern recognition
- Approaches for Pattern recognition (connectionist, statistical, syntactic)
- Pattern preprocessing (segmentation)
- Feature extraction and selection

- Pattern classification
- Machine learning (Supervised & Unsupervised learning)
- Post-processing
- Theory and traditional classifiers of biometric recognition techniques

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Construction Facility:
Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

Academic Support:
Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

1. Written Examinations to asses the intended learning outcomes
2. Class Activities (Reports, Discussions, ------) to asses The Intellectual Skills

Schedule:

Assessment 1 (7th and 12th Week Written Exam)

Assessment 2 (according to presentations time table)

Assessment 3 (continuous assessment)

Assessment 4 (16th week Final Exam)

Weighing of Assessment:

7th Week Examination	30 %
12th Week Examination	20 %
Final-term Examination	40 %
Oral Examination	0 %
Practical Examination	0 %

Semester Work	10 %
Total	100%

References

- K. Fukunaga, *Introduction to Statistical Pattern Recognition*, Academic Press, 1996
- Rabines, Juarg**,** *Fundamentals of Speech Recognition*, Englewood Cliffs, Prentice–Hall, 1993
- Duda and Hart**,** *Pattern Classification and Scene Analysis*, Wiley, 1973
- Chris Bishop**,** *Neural Networks for Pattern Recognition*, Oxford University Press, 1995.
- Vladimir N. Vapnick, *The Nature of Statistical Learning Theory*, Springer Verlag.

Course Code : **EC 721**

Course Title : **Advanced Digital Communications**

Credit Hours : **3**

Course Description

Characterization of signals and systems. Orthogonal expansions. Representations and spectra of digital modulated signals. Modulation and demodulation for AWGN channels signal waveforms. Optimum coherent detectors. Error probability for different M-array signals. Carrier recovery systems. Symbol synchronization methods. Noncoherent detection of M-array signals. Binary coding. M-array coded signals. Linear block coding. Soft and hard decision decoding. Convolution codes. Generation and decoding. Viterbi algorithm. Trellis code modulation.

Course Objectives

The student should become versed in the mathematical techniques used in dealing with modulation and synchronization as well as the different techniques of M-array digital signaling. Also, the student should be able to deal with channels coding either block or convolutional.

Course Topics

- Characterization of Signals and Systems
- Modulation and demodulation of M-array Signals
- Coding: binary, nonbinary block codes, convolution codes, TCM

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Define at least two different types of communications channels
- Explain the idea and theory behind continuous phase modulation
- Explain the different types and state the characteristics of continuous phase modulation
- Define the two types of demodulation techniques
- Explain the two types of synchronization processes
- Describe the two methods of channel coding concepts

Intellectual Skills

- Evaluate mathematically the probability of error of different continuous phase

modulation Techniques

- Apply continuous phase modulation concept in digital communication standard
- Apply channel coding concept in digital communication standard
- Apply synchronization concept in digital communication standard

Professional Skills

- Distinguish between linear and non linear modulation techniques
- Analyze the performance of continuous phase modulation
- Design continuous phase modulation system
- Analysis the performance of channel coding techniques
- Design channel coding technique system

General Skills

- Verify by Case studies the importance of continuous phase modulation concept in digital communication standard
- Verify by Case studies the importance of synchronization concept in digital communication standard
- Verify by Case studies the importance of channel coding concept in digital communication standard
- Provide presentation on new topics in ADC

Course Content

- General revision on digital communication systems
- The mathematical model of continuous phase modulation
- The transmitter characteristics of continuous phase modulation
- The receiver characteristics of continuous phase modulation
- Probability of error of continuous phase modulation in AWGN
- Synchronization techniques in time domain
- Phase estimation and compensation
- Equalization techniques
- Channel coding overview
- Linear block code

- Convolution code

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Academic Support:

- Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
- Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

1. Written Examinations
2. Presentations
3. Class Activities (Assignments, etc ------)
4. Final Examination

Schedule:

Assessment 1 (7th and 12th Week Written Exam)

Assessment 2 (according to presentations time table)

Assessment 3 (continuous assessment)

Assessment 4 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	20%
Assessment 3	10%
Assessment 4	40%
Total	100%

References

- J. Proakis and M. Salehi, *Digital Communications*, McGraw-Hill, 5th ed., 2007.
- S. Haykin, *Digital Communications*, Wiley, 1988.
- Lin and Costello, *Error Correcting Codes*, Prentice Hall, 2nd edition, 2004.

Course Code : **EC 722**

Course Title : **Optical Communications**

Credit Hours : **3**

Course Description

Optical Fiber Waveguides. Transmission Characteristics. Fiber and cable fabrication. Fiber connectors. Optical detectors. Optical amplifiers. Optical Multiplexing in optical systems. Optical Communication Systems. FTTH (Fiber-To-The-Home). Wireless Optical Communication

Course Objectives

- The student should have a very good background about the elements of the optical communication system, including: fiber, light source and detector and optical amplifier. He would be able to construct and adjust:
- A complete optical fiber communication system
- A simple optical network

Course Topics

- Optical Fiber Waveguides
- Transmission Characteristics
- Fiber and cable fabrication
- Fiber Connectors
- Optical Source
- Optical Detectors
- Optical Amplifiers
- Optical Multiplexing in optical systems
- Optical Communication Systems
- FTTH (Fiber-To-The-Home)
- Wireless Optical Communication

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Summarize using written report the course background.
- Show the fiber types from fiber physical characteristics.

- Explain using equations the electromagnetic theory used in understanding the light propagation down the fiber.
- Explain the loss mechanisms in optical fibers suing equations.
- Explain at least two types of dispersion in optical fibers.
- Describe the dispersion effect on bit rate that fiber can carry.
- distinguish between two types of emission
- List the optical devices that completes the optical communication system
- Examine practical optical communication systems.

Intellectual Skills

- Report the history of optical communications.
- Examine the modified fiber fabrication method using seminars.
- Classify the fiber connectors as oral exam.
- Select suitable optical source as oral exam
- Classify the light source as oral exam.
- Select light detector as oral exam.
- Examine the viability of the optical system

Professional Skills

- Prepare a good basis to understand the Optical Communications
- Explain the optical fiber definition.
- Classify the transmission characteristics and loss mechanisms.
- Classify the dispersion mechanisms.
- Perform the complete system evaluation using lab experiment perform the feasibility of the optical system using lab experiment.

General Skills

- Qualify the use of fiber.
- Verify the bit rate of the fiber.
- Propose the complete optical communication system as a case study.

Course Content

- Historical development: Historical background on communications, communication channels, light sources and detectors. General optical communication system. Advantages of optical fiber communications.
- Optical Fiber Waveguide: Ray theory transmission, Fiber acceptance angle and numerical aperture. Fiber types: step index – graded index – single mode – multimode.

- Electromagnetic theory for optical propagation – Normalized frequency of the optical fiber - Linearly polarized modes in optical fibers.
- Transmission Characteristics in Optical Fibers: Polarization – Attenuation: absorption, scattering, macrobending and microbending.
- Transmission Characteristics in Optical Fibers: Dispersion: definition and types – Bit rate calculation – Material and Waveguide Dispersion.
- Dispersion modified single-mode optical fibers - Intramodal dispersion – Overall dispersion.
- Fiber Fabrication – Fiber Cable Design – Fiber Connection: Couplers.
- Fiber Connection: Fiber splicing – Joint Loss: Fresnel reflection.
- Optical Sources: Requirements of light sources - Concept of light emission – spontaneous emission – stimulated emission – LED operation.
- Laser: Operation and types - Injection laser diode – Optical source limitations.
- Wavelength Converter – Optical Amplifiers.
- Light Detectors: Requirements - Photodetectors: Quantum efficiency and responsivity photodiodes.
- Optical Transmitter and Receiver: Optical transmitter circuits Optical receiver circuits.
- Optical fiber systems: Devices requirement, Optical fiber communication systems - Digital system, planning consideration.
- Optical Fiber Communication Systems: System Adjustment: power budget and rise time budget

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.

- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Academic Support:

- Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
- Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment

Procedures used:

1- Written exams to asses the overall knowledge & understanding gained through out the course.

2- Oral examination to asses the student's thinking ability to solve different problems & ideas discussed throughout the tutorials.

3- Class activities to asses the student's ability to solve the problems given throughout tutorials and their creative thinking.

4- Final examination

Schedule:

Assessment 1: (7th and 12th Week Written Exams)
Assessment 2: (7th and 12th Week Oral Exams)
Assessment 3: Continuous Assessments
Assessment 4: 16th Week Final Exam

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

References

- J. M. Senior, *Optical Fiber Communications: Principles and Practice*, Prentice Hall, 2nd ed., 1992.
- E. Desurivire, *Erbium-Doped Fiber Amplifiers*, Wiley, 1st ed., 1994.
- J.C. Palais, *Fiber Optic Communications*, Prentice Hall, 4th ed., 1998.
- E. Iannone, F. Matera, A. Mecozzi and M. Settembre, *Nonlinear Optical Communication Networks*, Wiley, 1st ed., 1998.

Course Code : **EC 723**
Course Title : **Satellite Communication Systems**

Credit Hours : **3**

Course Description

Orbit dynamics, frequency allocations, satellite antennas propagation effects, power budget and noise. Modulation techniques, digital modulation and coding, multiplexing and multiple-access techniques. Satellite transponders. Applications.

Course Objectives

The student should be able to understand the launching, detailed structure of the space and earth station and the different multiple access techniques that are used.

Course Topics

- Orbit dynamics
- Link budget parameters and calculations
- antenna types and coverage foot prints
- Frequency allocations
- Modulation and coding, multiple access techniques
- Satellite transponders
- Applications:
    - Internet via satellite
    - VSAT (Very Small Aperture Satellites)
    - Remote-sensing satellites
    - GPS (Global Positioning System)
    - GMDSS
    - Search and Rescue

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Interpret knowledge of mathematics, and engineering to determine location of a satellite in its orbit and calculate link budget

- Estimate the azimuth and elevation angles and visibility of a geostationary satellite from an earth station
- Identify, quote, and interpret engineering problems related to the design of satellite systems.
- Estimate programming techniques and tools to calculate satellite coordinates and look angles.

Intellectual Skills

- Calculate link budgets for an uplink and a downlink, and determine carrier to noise ratio (C/N) at an earth terminal receiver
- Calculate the base-band signal-to-noise ratio or bit error rate for a satellite link
- Determine the BER improvement obtained with various ARQ and FEC coding techniques
- Determine the effect of rain attenuation in a satellite link and the availability of the link based on the geographic location of the earth terminals
- Determine the type and dimensions of antennas for use on satellites and at earth station

Professional Skills

- Construct a communications satellite system to meet specified objectives for signal to noise ratio (S/N) in an analog baseband or BER in a digital link using appropriate multiple access techniques
- Construct satellite communication systems using GEO or LEO satellites to carry Voice, video, or data signals using analog or digital modulation

General Skills

- Practice software packages that support satellite communications
- Follow project work for identifying current problems and methods for remedy.
- Practice the current trends in satellite communication systems.
- Qualify critique research and estimate business proposals, in the space of satellite technology, presented by other students.

Course Content

- Satellite orbits and launching procedures, look angles
- Spacecraft: power, communications, TT&C, antenna systems
- Link budgets, C/N calculation
- Analog modulation techniques, S/N calculation
- Digital modulation, transmission, BER calculation

- Multiple Access techniques: FDMA, TDMA, CDMA, RA
- Coding and error control
- Propagation effects
- Case studies: DBS-TV, GPS, LEO and VSAT networks

Teaching and Learning Methods

- Lectures
- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

Construction Facility:

Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

Academic Support:

- Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
- Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

1- Written Examinations to assess The Intended Learning Outcomes.

2- Class Activities (Reports. Discussions, ----) to assess The Intellectual Skills.

Student Assessment

Procedures used:

1- Written exams
2- Seminars
3- Assignments
4- Discussions

Schedule:

Assessment 1 (7th Week Written Exam)
Assessment 2 (12th Week Written Exam)
Assessment 3 (continuous assessment)
Assessment 4 (16th week Final Exam)

Weighing of Assessment:

7th Week Examination	20 %
12th Week Examination	20 %
Final-term Examination	40 %

Oral Examination	10 %
Practical Examination	0 %
Semester Work	10 %
Total	100%

References

- Feher, K., *Satellite Communications Conference*, 1983.
- Moral, G., *Satellite Communications Systems: Techniques and Technology*, J. Wiley, 1993.
- Richharia, M., *Satellite Communications Systems*, MacMillan Press, 1995.
- Roddy Dennis, *Satellite Communication*, McGraw-Hill, 1995.

Course Code : EC 724
Course Title : Mobile and Spread Spectrum Communications

Credit Hours : 3

Course Description

Types and properties of different Spread Spectrum Techniques: DS, FH, Chirp and hybrid systems. Performance of DS systems in noise and interference. Processing Gain and Jamming Margin. Performance of FH systems. Spreading codes: M-sequences, Gold and Kassami codes, Walsh orthogonal codes. Analysis of DS-CDMA systems. Applications of spread-spectrum systems: GPS, wireless LANs, Spread-spectrum mobile systems (IS-95). Cellular mobile systems. Frequency reuse. Propagation effects on mobile channels: Attenuation, fading, multipath, shadowing and scattering. Teletraffic engineering impact on cellular systems. Co-channel interference and its reduction. Sectorization, handoff, channel sharing, micro and macro cells. GSM mobile systems. Spread-spectrum mobile communications. Student presentations and literature search on advanced topics including: Code optimization. Synchronization and tracking. 2.5 G mobile systems: WAP, GPRS and EDGE. 3G mobile systems based on spread-spectrum, CDMA2000 and UMTS. WCDMA. Considerations for 4G systems. Multi-user and Rake receivers. Multi-carrier CDMA systems.

Course Objectives

Students will be able to understand the types and properties of different spread spectrum techniques and spreading codes.

Course Topics

- Types and properties of different Spread Spectrum Techniques
- Performance of SS systems in noise and interference
- Spreading codes
- Applications of spread-spectrum systems
- Cellular mobile systems
- Propagation effects on mobile channels
- Teletraffic engineering impact on cellular systems
- GSM mobile systems — Spread-spectrum 2G mobile communications (IS-95)
- 2.5G and 3G mobile systems
- Selection of advanced topics

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Interpret knowledge of mathematics, and engineering to determine effect of medium on digital communication systems.
- Identify, quote, and interpret engineering problems related to the design of mobile and spread spectrum communication systems.
- Describe the types and advantages of spread spectrum modulation formats.
- Describe the difference and benefits of different types of spreading codes.
- Describe the difference between standard narrowband communication system and spread spectrum system.
- Describe techniques for reducing the impact of interference on spread spectrum signal.
- Describe the major factors influencing the capacity of CDMA wireless networks.

Intellectual Skills

- Determine the BER improvement obtained with various spread spectrum coding techniques.
- Determine the effect of interference on a mobile link and the availability of the link based on the geographic location of the earth terminals.
- Apply analysis on the performance of spread spectrum modulation formats.
- Determine and classify spread spectrum signals in the presence of multiple access interference (CDMA context).
- Determine and classify spread spectrum signals in the presence of interference.
- Determine and classify spread code acquisition and tracking circuits.

Professional Skills

- Experiment software packages that support mobile and cellular communications.
- Design a cellular communication system to meet specified objectives for signal to noise ratio (S/N) for BER In a digital link using appropriate modulation and multiple access techniques.
- Arrange teams to function through project work identifying current problems and methods for remedy.

General Skills

- Practice the current trends in mobile communication systems.
- Qualify critique research and estimate business proposals, in the space of mobile and cellular technology, presented by other students.

Course Content

- Introduction to spread spectrum.
- Review of digital communications.
- Propagation effects in mobile channels.
- Direct sequence spread spectrum.
- Frequency hopping.
- Pseudo-random sequence generation.
- Synchronization issues for spread spectrum.
- Performance of direct-sequence spread spectrum.
- Performance of frequency-hopped spread-spectrum CDMA.
- Interference rejection for DS/SS cellular mobile systems.

Other wide band techniques.

Teaching and Learning Methods

- Lectures
- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

Construction Facility:

Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

Academic Support:

- Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
- Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

1- Written Examinations to assess The Intended Learning Outcomes.

2- Class Activities (Reports. Discussions, ----) to assess The Intellectual Skills.

Student Assessment

Procedures used:

1- Written exams
2- Seminars

3- Assignments
4- Discussions

Schedule:

Assessment 1 (7th Week Written Exam)
Assessment 2 (12th Week Written Exam)
Assessment 3 (continuous assessment)
Assessment 4 (16th week Final Exam)

Weighing of Assessment:

7th Week Examination	20 %
12th Week Examination	20 %
Final-term Examination	40 %
Oral Examination	10 %
Practical Examination	0 %
Semester Work	10 %
Total	100%

References

- Lee, W.C.Y., *Mobile Communication Engineering*, McGraw-Hill, 1982.
- Steele, R. and Hanzo, L., *Mobile Radio Communications*, 2nd Ed., Wiley, 1999.
- Cooper, G. and McGillem, C., *Modern Communications and Spread Spectrum*, McGraw-Hill, 1998.
- Dixon, R., *Spread Spectrum with Commercial Applications*, Wiley, 1994.
- Jakes, W., *Microwave Mobile Communications*, Wiley, 1974.
- Holma, H. and Toskala, A., *WCDMA for UMTS; Radio Access for Third Generation Mobile Communications*, Wiley, 2000.

Course Code : **EC 725**
Course Title : **Speech Signal Processing and Digital Telephony**

Credit Hours : **3**

Course Description

Speech signals. Digital model of speech. Digital representation of the speech waveform. Linear predictive coding of speech. Digital speech processing for machine communication. Speech and speaker recognition. Digital telephony network hierarchy. Standard CCITT regulations. Circuit switching. Space division switching. Different protocols. Performance analysis of switched systems.

Course Objectives

The student should be versed in:

- Digital techniques and systems in the field of telephony
- Evolution of the telephony system from the analog form to the digital form

Course Topics

- Speech signals
- Coding of speech; speech and speaker recognition
- Digital telephony network
- Different protocols, performance of switched systems

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Interpret knowledge of mathematics, and engineering to determine effect of medium on digital communication systems.
- Identify, quote, and interpret engineering problems related to the design of mobile and spread spectrum communication systems.
- Describe the types and advantages of spread spectrum modulation formats.
- Describe the difference and benefits of different types of spreading codes.
- Describe the difference between standard narrowband communication system and spread spectrum system.
- Describe techniques for reducing the impact of interference on spread spectrum signal.
- Describe the major factors influencing the capacity of CDMA wireless networks.

Intellectual Skills

- Determine the BER improvement obtained with various spread spectrum coding techniques.
- Determine the effect of interference on a mobile link and the availability of the link based on the geographic location of the earth terminals.
- Apply analysis on the performance of spread spectrum modulation formats.
- Determine and classify spread spectrum signals in the presence of multiple access interference (CDMA context).
- Determine and classify spread spectrum signals in the presence of interference.
- Determine and classify spread code acquisition and tracking circuits.

Professional Skills

- Experiment software packages that support mobile and cellular communications.
- Design a cellular communication system to meet specified objectives for signal to noise ratio (S/N) for BER In a digital link using appropriate modulation and multiple access techniques.
- Arrange teams to function through project work identifying current problems and methods for remedy.

General Skills

- Practice the current trends in mobile communication systems.
- Qualify critique research and estimate business proposals, in the space of mobile and cellular technology, presented by other students.

Course Content

- Introduction to spread spectrum.
- Review of digital communications.
- Propagation effects in mobile channels.
- Direct sequence spread spectrum.
- Frequency hopping.
- Pseudo-random sequence generation.
- Synchronization issues for spread spectrum.
- Performance of direct-sequence spread spectrum.
- Performance of frequency-hopped spread-spectrum CDMA.
- Interference rejection for DS/SS cellular mobile systems.

Other wide band techniques.

Teaching and Learning Methods

- Lectures

- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

Construction Facility:

Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

Academic Support:

- Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
- Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

1- Written Examinations to assess The Intended Learning Outcomes.

2- Class Activities (Reports. Discussions, ----) to assess The Intellectual Skills.

Student Assessment

Procedures used:

1- Written exams
2- Seminars
3- Assignments
4- Discussions

Schedule:

Assessment 1 (7th Week Written Exam)
Assessment 2 (12th Week Written Exam)
Assessment 3 (continuous assessment)
Assessment 4 (16th week Final Exam)

Weighing of Assessment:

7th Week Examination	20 %
12th Week Examination	20 %
Final-term Examination	40 %
Oral Examination	10 %
Practical Examination	0 %
Semester Work	10 %
Total	100%

References

- Douglas O'Shaughnessy, *Speech Communications*, IEEE Press 2000.

- Thomas F. Quatieri, *Discrete-Time Speech Signal Processing*, Prentice Hall PTR 2001.
- Bellamy, *Digital Telephony*, Wiley, 1997.

Course Code : **EC 726**
Course Title : **Adaptive Signal Processing**

Credit Hours : **3**

Course Description

Procedures of Optimal Signal Processing and its applications. Introduction to Adaptive Signal Processing. Applications (Adaptive Noise Canceling, Adaptive Line Enhancer, Adaptive Echo Canceling). Algorithms and structures of adaptive signal processing. IIR Adaptive Filters, Lattice, Frequency Domain Implementation. Seminars given by the students.

Course Objectives

To provide a broad perspective of adaptive filtering techniques and their implementation, theoretical foundation, limitations, and practical constraints

Course Topics

- Review.
- Random signal analysis: Discrete Random Signals, Spectral Representations, Response of Linear Systems to Random Input, Random Signal Models, Estimation of Moments
- Optimal Signal Processing: Procedures, Filter Design, Applications
- Adaptive Signal Processing: Introduction, Least Mean Square Algorithm, LMS Performance
- Applications: Adaptive Noise Canceling, Adaptive Line Enhancer, Adaptive Echo Canceling, Adaptive Filters for Time-Delay, Applications to Communications
- Adaptive Signal Processing: Algorithms and Structures, LMS, RLS (Recursive Least Squares), IIR Adaptive Filters, Lattice, Frequency Domain Implementation

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Define at least two different types of ingredients in any adaptive systems
- Explain the idea and theory of Digital filters
- Explain the different types of correlations in discrete domain
- Explain the mathematics behind mean square error
- Explain the mathematics behind adaptive wiener filter
- Explain the mathematics behind mean square error
- Define the two types recursive filters

- Describe the two methods of Linear predictive coding

Intellectual Skills

- Evaluate mathematically the concept of correlations.
- Apply adaptive filter wiener concept on digital signals

Professional Skills

- Distinguish between FIR and IIR
- Analyze the performance of wiener filter
- Analysis the performance and complexity of adaptive filters
- Design a linear predictive filter
- Design a complete adaptive digital filter

General Skills

- Verify by Case studies the importance of Wiener filter
- Verify by Case studies the importance of mean square error functions
- Verify by Case studies the importance of adaptive filters
- Provide presentation on new topics in Advanced Signal processing.

Course Content

- Introduction adaptive signal processing
- Fundamentals of digital filters
- Autocorrelation and crosscorrelation functions
- Wiener filter
- Adaptive wiener filter
- Mean square error
- Least mean recursive filter
- Realization of adaptive filters
- Applications of adaptive filters in speech processing
- Applications of adaptive filters in image processing
- In class Presentation

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Academic Support:

- Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
- Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment

Procedures used:

- Written Examinations
- Presentations
- Class Activities (Assignments, etc ------)
- Final Examination

Schedule:

Assessment 1 (7th and 12th Week Written Exam)

Assessment 2 (according to presentations time table)

Assessment 3 (continuous assessment)

Assessment 4 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	20%
Assessment 3	10%
Assessment 4	40%
Total	100%

References

- Peter M. Clarkson, *Optimal and Adaptive Signal Processing*, by CRC Publishing
- B. Farhang-Boroujeny, *Adaptive Filtering: Theory and Applications*
- J.R. Treichler, C.R. Johnson, Jr., and M.G. Larimore, *Theory and Design of Adaptive Filters*
- Simon Haykin, *Adaptive Filter Theory*, 4th ed.

Course Code : **EC 727**
Course Title : **Communications Intelligence**

Credit Hours : **3**

Course Description

Theory of Cryptography, theoretical approach, some early cipher systems, mono and poly Alphabetic ciphers, statistical analysis, Mechanical Cryptography Devices, cipher systems, pure cipher, perfect cipher, Random cipher, Cryptoanalysis, Channon's Five criteria, worst case conditions, one time pad, stream cipher, linear shift register, finite state machine, nonlinear shift registers, techniques, nonlinearity, periodicity, Randomness, implementation, Block cipher systems, feedback cipher systems, Data Encryption Standard DES, key structure, key management, signature, Public key Cryptography, RSA, Taher El-Gamal and Elliptic curve cryptosystems, Encryption and Signature and hashing and implementation, Advanced encryption standard AES, voice Encryption, Scramblers and speech security systems, Digital watermarking, theoretical approach, techniques, Algorithms and implementation.

Course Objectives

The student will become versed in the theory of cryptography, Scrambling, key management, Protocols, stream cipher, data encryption standards, public key systems and digital watermarking.

Course Topics

- Cryptography
- Random Ciphers, Shannon's Criteria
- Block cipher
- Key structure, Data encryption standards
- Public key
- Digital Watermarking

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Understand the concept security and state two main reasons for applying security Systems
- Describe Classical encryption techniques
- Describe block ciphers and the data encryption standard
- Explain main functions of advanced encryption standard
- Explain public-key cryptography and RSA
- Explain hashing and scrambling techniques

Intellectual Skills

- Demonstrate and examine an internetworked system
- Discover and classify computer and security threats and develop a security model to prevent, detect and recover from attacks
- Determine and examine messages using well-known signature generation and verification algorithms
- Report the effectiveness of each speech security technique.

Professional Skills

- Students should be able to perform the basic rules of public key and symmetric encryption for practical cryptographic problems.
- Be able to experiment the design and use of hash functions, digital signatures, and key distribution with a wide range of key types.
- Analyze a problem in cryptography, design an algorithm to implement the solution for that problem

General Skills

- Follow key management and Practice the main process in management
- Qualify digital signatures and authentication protocols
- Groups discussion on applications of Chaotic Cryptography in communications systems
- Qualify a research and propose a business proposal in front of peers.

Course Content

- Introduction to security in communications
- Mathematical Foundations: Groups — Rings — Fields - The Fermat's
- Theorem - The Euler's Theorem.
- Symmetric Ciphers - Asymmetric Cipher Systems - Elliptic Curve Cryptosystems systems
- The RSA Algorithm - Key Management - Key Distribution
- Cryptographic Key Distribution Systems: Merkie's Puzzle Method.- Shamir's Key Distribution Method — Diffie-Heliman Key Exchange Distribution - Digital Signature Systems - The Trusted Third Party or Key Escrow Encryption System
- Chaotic Cryptographic Systems: Fundamentals of Chaotic Processes
- Application of Chaotic Systems to Communications- Application of Chaotic Systems to Cryptography
- Communication Security Layer Classifications - A Synergistic Security Framework.
- Firewalls and Gateways - Security Cross-Portfolio.

- Digital watermarking techniques
- Digital watermarking algorithms
- Speech security systems

Teaching and Learning Methods

- Lectures
- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

Construction Facility:

Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

Academic Support:

- Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
- Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

1- Written Examinations to assess The Intended Learning Outcomes.

2- Class Activities (Reports. Discussions, ----) to assess the Intellectual Skills.

Student Assessment

Procedures used:

1- Written exams
2- Seminars
3- Assignments
4- Discussions

Schedule:

Assessment 1 (7th Week Written Exam)
Assessment 2 (12th Week Written Exam)
Assessment 3 (continuous assessment)
Assessment 4 (16th week Final Exam)

Weighing of Assessment:

7th Week Examination	20 %
12th Week Examination	20 %
Final-term Examination	40 %
Oral Examination	10 %
Practical Examination	0 %
Semester Work	10 %
Total	100%

References

- Henry Becker and Fred Pioer, *Cipher Systems*.
- William Stallings, *Cryptography and Network Security*.
- I.J. Cox, M.L. Miller, J.A. Bloo, *Digital Watermarking*.

Course Code : **EC 728**
Course Title : **Communications Seminar**

Credit Hours : **3**

Course Description

A series of seminars with topics related to the field of communications such as spread spectrum, mobile communications, wireless communication networks, communications security, optical communications, Satellite Communications, Multi-media Communications, digital telephony, voice over IP, digital television and teleconference ISDN, ADSL and packet switching, application of digital Signal processing techniques in communications

Course Objectives

The student will gain knowledge about new trends in communications and be aware of the current research topics in that field. The student will prepare a seminar on one of the selected topic(s), present the seminar and get feedback from the academic staff as well as his/her colleagues in the course. A neatly written report with detailed analysis and references as well as comparisons and possibly simulations is also expected to be presented by the student.

Course Topics

- Spread Spectrum Techniques and applications
- Next G mobile Communication Systems
- Wireless Communication Networks
- Communications Security
- Optical communications (Topics different than those in EC 722)
- Satellite Communications (Topics different than those in EC 723)
- Application of Digital Signal Processing Techniques in Communications
- Multi-media Communication Systems
- Digital Telephony and Voice over IP (Topics different than those in EC 725)

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Interpret knowledge of mathematics, and engineering to analyze a communication system.
- Describe the specifications of a communication system.
- Identify, quote, and interpret engineering problems related to the design of communication systems.
- Understand what plagiarism is and how to avoid it.

- Define team work and importance of brain storming.

Intellectual Skills

- Demonstrate presentation that elaborates knowledge of mathematics, and engineering to analyze a communication system.
- Demonstrate presentation that reflects the specifications that describe a communication system.

Professional Skills

- Design advanced communication system to meet specified objectives for signal to noise ratio (S/N) or BER in a digital link using appropriate multiple access techniques.

General Skills

- Experiment software packages that support communications systems.
- Arrange teams to function through project work identifying current problems and methods for remedy.
- Practice the current trends in satellite communication systems.
- Qualify a critique research and propose a business proposals, in the space of communications technology, presented by other students.

Course Content

- Introduction to communication skills.
- Writing research articles skills.
- Reading research articles skills.
- Presentations skills.
- Research skills.
- Team work and brain storming.
- Plagiarism and intellectual properties.
- Topics in communications.

Teaching and Learning Methods

- Lectures
- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

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Academic Support:

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Student Assessment

Procedures used:

1- Written exams
2- Seminars
3- Assignments
4- Discussions

Schedule:

Assessment 1:	(7th Week Written Exams)
Assessment 2:	(12th Week Oral Exams)
Assessment 3:	Continuous Assessments
Assessment 4:	16th Week Final Exam

Weighing of Assessment:

7th Week Examination	20 %
12th Week Examination	20 %
Final-term Examination	40 %
Oral Examination	10 %
Practical Examination	0 %
Semester Work	10 %
Total	100%

References

- According to the subject of the seminar.

Course Code : EC 729
Course Title : Applications of SAW and CCD in Communication Systems

Credit Hours : 3

Course Description

Part 1: Surface Acoustic Wave (SAW) devices, interdigital transducer, dispersive, no dispersive, models, fabrication, matching networks, delay lines, bandpass filters, dispersive, nondispersive, filter design, phase coded, correlates, convolvers, reflecting grating, FM chip filters, resonators, radar equipments, sensors, antenna duplexers and oscillators in Mobile and wireless communication.

Part 2: Charge-coupled devices (CCD), technologies, MOS capacitor, transfer mechanism, surface channel, buried channel, transfer electrodes. Applications of CCD, analog delay lines, time division multiplexing, filters, correlators, digital memories, logic arrays, imaging sensors, CCD camera.

Course Objectives

The student should be versed in surface acoustic wave (SAW), SAW devices, SAW components in mobile and wireless communications, charge-coupled devices (CCD), CCD devices, CCD in imaging and analog signal processing.

Course Topics

- Surface acoustic wave (SAW)
- SAW devices
- SAW components in mobile and wireless communications
- Charge coupled devices (CCD)
- CCD devices

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

Intellectual Skills

The students should be able to:

- Quote the saw transducer types and characteristics
- Analyze the FM chip filters
- Analyze single, multi, and coupled resonators
- Classify CCDs according to the applications
- Quote the applications of the MOS capacitor
- Classify channels and transfer electrodes
- Apply design techniques for delay lines

- Quote the applications of CCDs in time division multiplexing
- Apply the concept of the CCD camera to imaging sensors

Professional Skills

- Apply dispersive techniques for the design of band pass filters
- Apply non dispersive techniques for saw band pass filters
- Demonstrate the ability to design saw FM chip filters
- Distinguish between different types of CCDs
- Distinguish between different types of delay lines
- Compare the performance of time division multiplexing using CCDs with classical techniques
- Acquire an in depth knowledge about the applications of the CCDs

General Skills

- Practice the analysis and design of saw band pass filters
- Acquire an in depth knowledge about the saw applications
- acquire an in depth knowledge about the applications of saw resonators in mobile communications
- Gain a deep insight about the applications of the CCDS

Course Content

- Saw transducers
- Band pass filters(dispersive design)
- Band pass filters (non dispersive design)
- Phase coding & convolvers-
- Correlators & reflection grating
- Saw FM chip filters
- Saw resonators
- Applications of saw in radars
- CCD technology basics
- MOS capacitors
- Applications CCD in analog delay lines
- Applications of CCD in time division multiplexing-

- Applications of CCD in digital memories
- CCD camera& imaging sensors

Teaching and Learning Methods

- Lectures
- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

Handicapped Students should be informed that the Electronics and Communications department presents facilities that support education embedded in the following:-

Construction Facility :

Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

Academic Support :

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.

Health Care :

Inside interior clinic of the academy

Library Service :

Membership applications are available at the secretary of the department to meet the needs of the handicapped students.

Fundamental programmers of support and care :

Handicapped Students could access Moodle programme to download a copy of the lectures and exercises according to the subjects registered each term. Benches are built for handicapped students by utility and maintenance department under the supervision of Mrs/ Soheir El-Halafawi vice dean of the academy for finance and logistics .

Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement.

Student Assessment

Procedures used:

Written Examinations to assess The Intended Learning Outcomes Class Activities (Reports, Discussions, ------) to assess The Intellectual Skills

Schedule:

Assessment 1	7th Week Written Exam
Assessment 2	12th Week Written Exam
Assessment 3	Continuous Assessments
Assessment 4	16th Week Final Written Exam

Weighing of Assessment:

7th Week Examination	30 %
12th Week Examination	20 %
Final-term Examination	40 %
Seminar+ project	10 %
Total	100%

References

- H. Mathews, *Surface Wave Filters*.
- *Surface acoustic wave devices for mobile and wireless communications*.
- A. H. W. Beck, J. Jamb, *Charge coupled devices*.

Course Code : **EC 730**
Course Title : **Audio and Video Compression**

Credit Hours : **3**

Course Description

Multimedia has become an essential part of modern computer and communication technology. In this course, students will be introduced to principles and current technologies of multimedia systems. Issues in effectively representing, processing, and retrieving audio and video data. The students will gain hands-on experience in those areas by implementing some components of a multimedia streaming system as their term project. Latest standard technologies and some advanced topics in current multimedia research will also be discussed.

Course Objectives

To provide a broad treatment of the fundamentals of speech, image, audio and video processing.

Course Topics

- Introduction to Multimedia
- Audio/Video fundamentals including analog and digital representations, human perception, and audio/video equipment
- Topics in data compression including coding requirements, source, entropy, and hybrid coding
- Elements of Image Compression System
- Video Coding: Fixed-length and Variable-length Codes
- Lossless and Lossy Compression
- Discrete cosine transforms
- Short-term Fourier Transform and Continuous Wavelet Transform
- CWT, Discrete Wavelet Transforms and 2D Wavelet Transforms
- Motion Estimation: Matching Criteria and Generalized Matching
- Still image compression standards: JPEG, JPEG-2000
- Video Compression Standards: overview, H.261
- MPEG-1, MPEG-2 and MPEG-4 Standards: specifications

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Define at least two different types of ingredients in any multimedia systems
- Explain the idea and theory behind source coding
- Explain the different types and state the characteristics of audio compression
- Explain the different types and state the characteristics of video compression
- Define the two types of motion estimation
- Explain at least two types of transformation methods
- Describe two standards of multimedia systems

Intellectual Skills

- Evaluate mathematically the concept of source coding.
- Apply source coding concept on audio signals
- Apply source coding concept on audio signals
- Apply video compression concept on video signals
- Apply motion estimation concept on video signals

Professional Skills

- Distinguish between lossless and lossy compression
- Analyze the performance of source coding
- Design video compression system
- Analysis the performance of transformation techniques
- Design a complete multimedia system

General Skills

- Verify by Case studies the importance of source coding
- Verify by Case studies the importance of video coding
- Verify by Case studies the importance of transformation coding concept
- Provide presentation on new topics in ADC

Course Content

- Introduction to Multimedia
- Audio and video fundamentals
- Data compression
- Image compression techniques
- Video coding
- Motion estimation
- Transformation methods
- Multimedia standards

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.

- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Academic Support:

- Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
- Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

1. Written Examinations
2. Presentations
3. Class Activities (Assignments, etc ------)
4. Final Examination

Schedule:

Assessment 1 (7th and 12th Week Written Exam)

Assessment 2 (according to presentations time table)

Assessment 3 (continuous assessment)

Assessment 4 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	20%
Assessment 3	10%
Assessment 4	40%
Total	100%

References

- Ze-Nian Li and Mark S. Drew, "*Fundamentals of Multimedia*", Pearson Education, 2004.

Course Code : **EC 731**
Course Title : **Advanced Digital Signal Processing**

Credit Hours : **3**

Course Description

Applications of DSP Discrete Transform Domains. Introduction to Multirate signal processing. Application of Multirate signal processing as: Quadrature Mirror Filterbank (QMF), multirate filterbank, and transmultiplexers. Adaptive filters. Wavelet Transforms and some of its applications. Spectrum Estimation. Theory and traditional classifier. Seminars given by the students.

Course Objectives

To become familiar with multirate signal processing and its applications, Adaptive filters, wavelet transform and traditional classifiers used in biometric recognition techniques

Course Topics

- Review (Z-transform, Correlation, Digital filter design)
- Discrete Transform domains (DCT, Walsh, Hadamard Transforms)
- Multirate signal processing
- Multirate filterbanks (QMF – M-filterbanks – Multiplexers)
- Adaptive filters
- Wavelet Transform
- Spectrum Estimation
- Theory and traditional classifiers of biometric recognition techniques

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Describe the transformation matrix
- Explain the steps of digital filter design
- Define correlation
- Describe DCT transform and its relation to DFT
- Define Walsh and Hadamard transforms
- Explain Multirate signal processing
- Define Multirate filterbanks

- Describe QMF, M filterbanks, and Multiplexers
- Describe the idea behind adaptive filters
- Define wavelet transform
- Identify QMF as the building block of wavelet transform
- Define spectrum estimation
- Define classifiers of biometric recognition techniques

Intellectual Skills

- Apply different transforms to a given data sequence
- Calculate the correlation function (auto-correlation and cross-correlation)
- Apply DCT, Walsh, Hadamard Transforms to a given data sequence
- Apply down-sampling and up-sampling to a given discrete signal
- Calculate the outputs of QMF
- Examine the required condition to have desired outputs of QMF
- Demonstrate some of the application of adaptive filters
- Construct an adaptive filter and choose adaptation algorithm
- Apply DWT to a given data sequence
- Apply estimation of the spectrum
- Select suitable classifier to a specific biometric technique

Professional Skills

- Compare between classifiers
- Design a digital filter
- Perform DFT and FFT transforms
- Analyze the outputs of the transforms and compare between them according to the application
- Design a multirate system
- Analyze a multirate system
- Analyze multirate filterbanks
- Compare between M filterbanks and Multiplexers
- Analyze and adaptive filter such as adaptive noise canceller
- Design an adaptive filter such as linear combiner
- Compare between DWT and DFT
- Analyze spectrum estimation steps

General Skills

- Propose a modification to improve digital filter performance
- Verify the results of the transforms
- Verify the output of a multirate system
- Practice design of M filter banks and multiplexers
- Practice adaptive filter design
- Verify the results of an adaptive filter.
- Propose a DWT transform (no. of levels, type of wavelet filters, etc)
- Verify the classifier outputs.

Course Content

- Review (Z- transform , Correlation, Digital filter design)
- Discrete Transform domains (DCT, Walsh, Hadamard Transforms)
- Multirate signal processing
- Multirate filterbanks (QMF – M filterbanks – Multiplexers)
- Adaptive filters
- Wavelet Transform
- Spectrum Estimation
- Theory and traditional classifiers of biometric recognition techniques

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Construction Facility:

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Academic Support:

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- Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment

Procedures used:

1- Written exams

2- Seminars

3- Assignments

4- Discussions

Schedule:

Assessment 1 (7th and 12th Week Written Exam)
Assessment 2 (according to presentations time table)
Assessment 3 (continuous assessment)
Assessment 4 (16th week Final Exam)

Weighing of Assessment:

7th Week Examination	30 %
12th Week Examination	20 %
Final-term Examination	40 %
Oral Examination	0 %
Practical Examination	0 %
Semester Work	10 %
Total	100%

References

- E. C. Ifeachor and B. W. Jervis, *Digital Signal Processing: A Practical Approach,* Prentice Hall, 2002
- Steven W. Smith, *The Scientist and Engineer's Guide to Digital Signal Processing*
- Saeed V. Vaseghi, *Advanced Digital Signal Processing and Noise Reduction*, 3rd Ed., Wiley, 2006

Course Code : **EC 732**
Course Title : **Automated Measurements**

Credit Hours : **3**

Course Description

Sensing and measurements of non-electrical quantities. Different types of sensors. Signal conditioning. Data acquisition systems. Data storage and processing. Projects.

Course Objectives

The aim of this course is to introduce electronic instrumentation systems, including different sensor/transducer elements for physical measureands, their respective interface electronics and precision measurement techniques.

Lecture Syllabus

- Fundamentals of Data Acquisition
- Analog and Digital Signals
  - Sensors and transducers
  - Transducer characteristics
  - Resistance Temperature Detectors (RTD), Thermostats, Strain Gauges, Wheatstone Bridge
- Signal Conditioning
  - Types of signal conditioning (Amp., filters, linearization, …)
  - Classes of signal conditioning
  - Noise and interference
- ADC and DAC
- Sensor Buses and Network protocols
  - RS 232, RS 485
  - Flow control protocols
  - ASCII based protocol
  - Error detection (ex, CRC)
- Universal Serial Bus (USB)
  - USB structure
  - Physical layer

- Data link layer

- Smart Sensors
  - Temperature IC and Smart Sensors
  - Pressure IC and Smart Sensors
  - Intelligent Opto Sensors
  - Chemical and Gas smart sensors

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Know and understand Different types of transducers.
- Label the strain measurements.
- Estimate the sensitivity of strain gages and describe sources of errors.
- Describe different recording instruments.
- Explain the specific circuit of piezoelectric transducers.
- Quote voltage regulator circuits and power supplies.
- Examine signal conditions.

Intellectual Skills

The students should be able to:

- Discover the circuits for all types of transducers.
- Experiment the different applications of transducers.
- Construct the circuits of strain measurements.
- Select the suitable design for the piezoelectric transducer.
- Experiment different types of recording instruments
- Experiment different types of regulators circuits.
- Select the suitable type of signal conditioning circuit.
- Demonstrate the ability to acquired data about specific topics.

Professional Skills

- The students should be able to:
- Design the transducers circuits
- Experiment transducers in different applications.

- Design the strain measurement circuits by using different methods.
- Experiment different types of recording instruments.
- Design different types of attenuators and amplifiers circuits.
- Experiment different devices according to its application.
- Design the piezoelectric circuits.

General Skills

- The students could qualify different types of transducers and practice different applications of them.
- The students could sketch transducer circuits and practice measurements on it. In addition, comply with different software's to make interface with the transducer circuit and computer.
- The students practice experience and communication skills in working as a team in a small project.

They can qualify complex application according to the gained information from this course.

Course Content

- The instrumentation system, Transducers, basic requirements of transducers, structure of Resistive position, and Strain gauge transducers.
- Linear Variable Differential Transformer, Shaft encoders and Different types of temperature transducers.
- Photoelectric transducers, capacitive transducers and Thermal conductivity gas transducer.
- Humidity Measurements, Ultrasonic level transducers, Hall effect and biomedical transducers.
- Strain Measurements: constant voltage potentiometer circuit and constant current potentiometer circuit.
- Wheatstone bridge circuit with constant voltage and Wheatstone bridge circuit constant current circuit.
- Measurement of sensitivity of strain gauges: single active strain gauge, double active strain gauge, three active strain gauges, four active strain gauges, load wire connections and switching (single pole and three poles switches).
- Recording Instruments: Direct measurements, Null balance bridges, Wheatstone bridge with oscilloscope and calibration resistance method.
- Piezoelectric Transducers: Voltage follower circuit, Charge amplifier circuit and Built-in voltage follower circuit.
- Power supplies and voltage regulators circuits: Batteries, Line voltage power

supply, Discrete voltage regulators, Series type and shunt type voltage regulators, IC voltage regulators, Adjustable voltage regulators and performance of power supply circuit (load effect, source effect, temperature effect, drift stability).

- Signal conditioning circuits: Amplifiers circuits and its characteristics.
- Signal conditioning circuits: Attenuators circuits (L-type, T-type, Pi-type) and its characteristics.
- Seminars and project.
- Seminars and project.
- Seminars and project.
- Seminars and project.

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Construction Facility:

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Academic Support:

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- Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Health Care:

- Inside interior clinic of the academy

Library Service :

- Membership applications are available at the secretary of the department to meet the needs of the handicapped students.

Fundamental programmers of support and care:

- Handicapped Students could access Moodle programme to download a copy of the lectures and exercises according to the subjects registered each term. Benches are built for handicapped students by utility and maintenance department under the supervision of Mrs/ Soheir El-Halafawi vice dean of the

academy for finance and logistics.

- Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement.

Student Assessment

Procedures used:

1- Written exams

2- Seminars

3- Assignments

4- Discussions

Schedule:

Assessment 1 (7th and 12th Week Written Exam)

Assessment 2 (according to presentations time table)

Assessment 3 (continuous assessment)

Assessment 4 (16th week Final Exam)

Weighing of Assessment:

7th Week Examination	30 %
12th Week Examination	20 %
Final-term Examination	40 %
Seminar+ project	10 %
Total	100%

References

- John Park and Steve Mackey “Practical Data Acquisition for Instrumentation and control systems”, Newnes publisher, 2003, ISBN: 0750657960

- Nikolay Kirianaky and others “ Data Acquisition and Signal Processing for Smart Sensors”, John Wiley&Sons, ISBN:0470843179

- Ramon Pallaa Sareny, Joun G. Webster, “Sensors and signal conditioning”, Joun Wiley & Sons, INC, 2001.

Course Code : EC 733
Course Title : Photonic Devices

Credit Hours : 3

Course Description

Radiative transition and optical absorption. Light-emitting diodes, visible and infra-red LED's. Semiconductor laser. Electronic and optical properties of semiconductor materials. Semiconductor heterostructures and quantum wells. Laser structures, operation and characteristics. Photodetectors and photoconductors. Photodiodes and avalanche Photodiodes. Optoelectronic integrated circuits (OEIC's). Solar cells: solar radiation, homojunction and heterojunction solar cells.

Course Objectives

The student should understand the theory and operation of different semiconductor devices used in optical communication as well as in other optoelectronic applications.

Course Topics

- Semiconductor devices for photonic applications
- Fabrication of photonic devices
- Characteristics of photonic devices
- Applications of photonic devices

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Students will be able to define the basic knowledge, concepts of radiative transition and optical absorption.
- Student will be able to define the basic knowledge, concepts of electronic and optical properties of semiconductor materials.
- Student will be able to understand the construction and operation of light-emitting diodes, visible and infra-red LED's.
- Student will be understand the construction and operation of semiconductor laser, semiconductor heterostructures and quantum wells, laser structures, operation and characteristics.
- Student will be able to define and understand the construction and operation of photodetectors and photoconductors, photodiodes and avalanche photodiodes.
- Student will be able to define and understand the construction and operation of optoelectronic integrated circuits (OEIC's).
- Student will be able to define and understand the construction and operation of solar cells, solar radiation, homojunction and heterojunction solar cells.

Intellectual Skills

- Students will be able to demonstrate, calculate and explain data and design experiments to obtain new data using 2 design assignments.
- Students will be able to examine semiconductor devices using computer programs.
- Student will be able to demonstrate the learning to simulate various semiconductor optical devices
- Student will be able to demonstrate the learning to plot 3D patterns of various antennas using 2 assignments using a simulating program.

Professional Skills

- The student will be able to experiment a computer programs for analyzing and designing optical semiconductor devices using a written report.
- Students will be able to analyze, compare, and design a system using a professional discussion.
- Students will be able to distinguish relevant laboratory equipment and analyze the results correctly using a written report.

General Skills

- The students will able to comply experience and facility in systematic approaches to solve problems with efficiency 80 %.
- Student will be able to comply the electronic and optical properties of semiconductor materials.
- The students will be able to communicate effectively, both orally and in writing using a case written report.

Course Content

- Radiative transition and optical absorption.
- Electronic and optical properties of semiconductor materials (I).
- Electronic and optical properties of semiconductor materials (II).
- Light-emitting diodes, visible and infra-red LED's (I).
- Light-emitting diodes, visible and infra-red LED's (II).
- Semiconductor laser. Semiconductor heterostructures and quantum wells
- 7th week exam
- Laser structures, operation and characteristics (I).
- Laser structures, operation and characteristics (II).
- Photodetectors and photoconductors.

- Photodiodes and avalanche Photodiodes.
- 12th week exam.
- Optoelectronic integrated circuits (OEIC's).
- Solar cells: solar radiation, homojunction and heterojunction solar cells (I).
- Solar cells: solar radiation, homojunction and heterojunction solar cells (II).
- Final examination.

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Handicapped students should sit close to the main exits of the class to be able to

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability,
- The handicapped students sit in fixed suitable places whether at the front or the back of the class to evacuate in case of emergencies like fires.

Academic Support:

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Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment

Procedures used:

1- Quizzes to assess the understanding of theoretical principles
2- Assignments to assess students' ability to practically imply theoretical principles.
3- Term paper to assess surveys and report writing.
4- A project to assess overall understanding of the course

Schedule:

Assessment 1 (7th and 12th Week Written Exam)
Assessment 2 (7th and 12th Week oral Exam)
Assessment 3 (7th and 12th Week practical Exam)
Assessment 4 (continuous assessment)
Assessment 5 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

References

- S. M. Sze, *Semiconductor Devices: Physics and Technology*, J. Wiley, 1988.
- J. Singh, *Semiconductor Optoelectronics: Physics and Technology*, McGraw-Hill, 1995.
- E. Rosencher and B. Vinter, *Optoelectronics*, Cambridge University Press, 2002.

Course Code : **EC 734**

Course Title : **Non-Silicon Semiconductors**

Credit Hours : **3**

Course Description

II-VI Compound semiconductors: nature, properties, crystal growth, optical properties, transport properties, and applications. III-V Compound semiconductors: nature, properties, crystal growth, optical properties, transport properties, and applications.

Course Objectives

The student is introduced to II-VI and III-V compounds semiconductors and should be able to understand their preparation, properties and applications.

Course Topics

- Properties of II-VI and II-V Compounds
- Single-crystal growth and properties
- Optical properties
- Transport properties
- Applications of II-VI and II-V Compounds

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Students will be able to define Properties of II-VI Compounds.
- Students will be able to define Properties of II-V Compounds.
- Student will be able to describe Single-crystal growth and properties of compound semiconductors.
- Student will be able to define Optical properties of compound semiconductors.
- Student will be able to define Transport properties of compound semiconductors.
- Student will be able to describe the applications of II-VI and II-V compound semiconductors.

Intellectual Skills

- Student will be able to demonstrate the learning to Single-crystal growth of compound semiconductors.

- Students will be able to demonstrate, calculate and report data and apply experiments to obtain new data using 2 design assignments.
- Student will be able to demonstrate the learning to demonstrate properties of compound semiconductors.

Professional Skills

- Students will be able to select appropriate tools to measure compound semiconductor performance.
- The student will be able to experiment a computer program for simulating single-crystal growth of compound semiconductors using a written report.
- Students will be able to analyze, compare, and design a compound semiconductor application using a professional discussion.
- Students will be able to distinguish relevant laboratory equipment and analyze the results correctly using a written report.

General Skills

- The students will able to comply experience and facility in systematic approaches to solve problems with efficiency 80 %.
- The students will be able to communicate effectively, both orally and in writing using a case written report.

Course Content

- Properties of II-VI and II-V Compounds (I).
- Properties of II-VI and II-V Compounds (II).
- Properties of II-VI and II-V Compounds (III).
- Properties of II-VI and II-V Compounds (IV).
- Single-crystal growth and properties (I).
- Single-crystal growth and properties (II).
- 7th week exam.
- Optical properties (I).
- Optical properties (II).
- Transport properties (I).
- Transport properties (II).
- 12th week exam.
- Applications of II-VI and II-V Compounds (I).
- Applications of II-VI and II-V Compounds (II).

- Applications of II-VI and II-V Compounds (III).
- Final examination.

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability,
- The handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to to evacuate in case of emergencies like fires.

Academic Support:

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.

Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment

Procedures used:

1- Quizzes to assess the understanding of theoretical principles
2- Assignments to assess students' ability to practically imply theoretical principles.
3- Term paper to assess surveys and report writing.
4- A project to assess overall understanding of the course

Schedule:

Assessment 1	(7th and 12th Week Written Exam)
Assessment 2	(7th and 12th Week oral Exam)
Assessment 3	(7th and 12th Week practical Exam)
Assessment 4	(continuous assessment)
Assessment 5	(16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

References

- S. M. Sze, *VLSI Technology*, 2nd Ed., McGraw-Hill, 1988.
- S. M. Sze, *Semiconductor Devices: Physics and Technology*, Wiley, 1985.
- Selected papers

Course Code : **EC 735**

Course Title : **Electronics Seminar**

Credit Hours : **3**

Course Description

VLSI integrated circuits fabrication technology, Integrated circuit fabrication process simulation, Analog integrated circuits, Digital integrated circuits, RF integrated circuits, Low-power devices and circuits, Nanostructures: devices and circuits, MEMs and NEMs, Integrated optoelectronics, Data converters, Electronic filters and switched-capacitor circuits, Solar cell fabrication, GaAs Devices, Speech and Image Signal Processing, and Neural Networks.

Course Objectives

The student should be familiar with the processes used in VLSI technology, and different applications in analog, digital, and RF integrated circuits, OR A/D and D/A converters, OR electronic filters, OR Speech or Image processing.

Course Topics

- One of the following topics:
- VLSI integrated circuit technology
- Data Converters
- Electronic Filters
- Speech or Image Signal Processing

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Understand VLSI integrated circuit technology.
- Understand operation and Design of Data Converters.
- Understand operation and Design of Electronic Filters.
- Understand operation and design of RF integrated circuits.
- Understand modern Nano Electronics theory and applications.
- Understand techniques, theory and applications of Speech or Image Signal Processing.

Intellectual Skills

- Discover Electronic and Signal Processing Design
- Solve Electronic and Signal Processing Problem.

Professional Skills

- Distinguish VLSI integrated circuit technology.
- Design of Data Converters.
- Design of Electronic Filters.
- Design of RF integrated circuits.
- Explain Nano Electronics theory and applications.
- Design and applications of Speech or Image Signal Processing.

General Skills

- Practice techniques..
- Follow IC Fabrication Processes.

Course Content

- One of the following topics:
- VLSI integrated circuit technology.
- Data Converters.
- Electronic Filters.
- RF integrated circuits.
- Nano Electronics.
- Speech or Image Signal Processing.

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability,
- The handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to to evacuate in case of emergencies like fires.

Academic Support:

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.

Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment

Procedures used:

1- Quizzes to assess the understanding of theoretical principles
2- Assignments to assess students' ability to practically imply theoretical principles.
3- Term paper to assess surveys and report writing.
4- A project to assess overall understanding of the course

Schedule:

Assessment 1 (7th and 12th Week Written Exam)
Assessment 2 (7th and 12th Week oral Exam)
Assessment 3 (7th and 12th Week practical Exam)
Assessment 4 (continuous assessment)
Assessment 5 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

References

- P.R. Gray, R.G. Meyer, *Analysis and Design of Analog Integrated Circuits*, 2nd Ed., 1984
- S.M. SZE, *VLSI Technology*, McGraw-Hill, 1988.
- Seetzer, Prezk, Hamdy, *Electronic Analog to Digital Converters*, Wiley
- L. Ludeman, *Fundamentals of DSP*, Harper and Row.
- Selected papers

Course Code : **EC 736**

Course Title : **Neural Networks Applications**

Credit Hours : **3**

Course Description

Computing Methods based on Structure and Operation of the Human Brain, Physiological Principles and Neural Architectures, Interconnected Networks, Back-propagation Learning, Medical Applications of Artificial Intelligence and Expert Systems.

Course Objectives

Students should become acquainted with principles of biomedical computing in Signal Processing.

Course Topics

- Computing Methods based on Structure and Operation of the Human Brain
- Physiological Principles and Neural Architectures
- Interconnected Networks Back-propagation Learning
- Medical Applications of Artificial Intelligence and Expert Systems

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Describe Neural Network (NN) concept.
- Summarize history of NN
- Show importance and applications of NN.
- Describe fundamentals of NN.
- Describe single layer perceptron
- Identify Multi-layer perceptrons
- Show backpropagation NN
- Explain unsupervised learning in NN
- Describe Radial Basis Function and recurrent NN
- Explain stochastic NNs
- Describe Self Organizing Maps
- Explain Support vector machines.
- Show other ANN.

- Show ANN using Matlab
- Show applications of ANN

Intellectual Skills

- Demonstrate concept of NN.
- Examine ingle layer perceptron with different problems
- Discover multilayer perceptron and it strength for solving nonlinear separator problems.
- Demonstrate Backpropagation algorithm
- Examine backpropagation NN strength.
- Demonstrate unsupervised learning algorithms.
- Demonstrate Radial basis function and recurrent NN.
- Demonstrate SOM
- Examine SVM
- Discover usage of Matlab with NN
- Discover applications of NN.

Professional Skills

- Design basic NN.
- Design single layer perceptron.
- Design Multilayer perceptron
- Analyze and design backpropagation NN.
- Distinguish between supervised and unsupervised learning algorithms.
- Compare RBF NN with other NN.
- Design SOM.
- Design and analyze SVM
- Compare various types of NNs.
- Analyze NNs for different applications

General Skills

- Practice solving basic problems using NN
- Practice solving problems using single layer perceptron

- Practice solving problems using single layer perceptron
- Practice designing back propagation NN
- Label supervised and unsupervised learning algorithms.
- Practice SVM.
- Estimate NN types for different applications

Course Content

- Introduction.
- Fundamentals of Neural Networks
- Single Layer Perceptrons
- Multilayer Perceptrons
- Back-propagation NN
- Back-propagation NN
- Unsupervised learning
- Radial Basis Function (RBF) and Recurrent NNs
- Stochastic NNs
- Self Organizing Maps (SOM)
- Support Vector Machines (SVM)
- Other ANN
- ANN Applications I
- ANN Applications II
- ANN Applications III

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Construction Facility:

Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

Academic Support:

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.

Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment

Procedures used:

1. Written Examinations to asses the intended learning outcomes
2. Class Activities (Reports, Discussions, ------) to asses the Intellectual Skills

Schedule:

Assessment 1 (7th and 12th Week Written Exam)
Assessment 2 (according to presentations time table)
Assessment 3 (continuous assessment)
Assessment 4 (16th week Final Exam)

Weighing of Assessment:

7th Week Examination	30 %
12th Week Examination	20 %
Final-term Examination	40 %
Oral Examination	0 %
Practical Examination	0 %
Semester Work	10 %
Total	100%

References

- P. R. Lippman, J. E. Moody, and D. S. Touretzky, *Advances in Neural Information Processing Systems*, Morgan Kauffman, 1991.

Course Code : **EC 737**

Course Title : **Advanced Digital VLSI Design and Testing**

Credit Hours : **3**

Course Description

This course scopes on design of VLSI digital circuits, Stick diagrams, design rules, CAD system, speed and power considerations, floor planning, layout techniques. Also, it gives a deep knowledge about VLSI testing techniques and design for testability.

Course Objectives

This course concerns about many aspects of Digital VLSI design. It introduces a study of CMOS devices, characteristics and fabrication. Combinational and sequential logic design. Analysis of deep submicron transistors.

Lecture Syllabus

- Moore's Law
- CMOS Manufacturing Process
- CMOS Devices
    - Devices Operation
    - Devices Models
    - Analysis of secondary and deep submicron parameters
- Chip Interconnects and Parasitic Parameters
- Design of Static Combinational Circuits
    - Standard Cell.
    - Fan in, fan out,
    - Power, energy and energy delay.
- Ratioed Logic
    - Pseudo nMOS
    - Differential Cascode Voltage Switch Logic (DCVSL)
- Dynamic Logic Circuits
- Design of Sequential Logic Circuits
    - Bistability and Metastability
    - Pipelining
    - Noise suppression

- System on Chip

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Know and understand:

  -The main components of combinational logic circuits

  - the main components of the sequential logic circuits
- Define the resistance of uniform slap of a conductor
- Define the diffusion capacitance
- Quote the basic operation of a logic inverter
- Summarize the hot electron effects
- Label the design strategies'
- Explain the chip design options
- Label semiconductor design
- Know how to use VHDL to synthesize circuits

Intellectual Skills

- The students should be able to:
- Demonstrate the realization of logic functions using standard techniques (K-Maps).
- Examine the different design categories (fully custom and semi custom).
- Relate physical problems into state table, state transition diagram and state machines
- Select the suitable design methodology suitable for a given problem.
- Construct the design using Moore or Mealy machines
- Analyze the scaling principles
- Classify programmable logic arrays

Professional Skills

- Distinguish different types of masking
- Analyze the cost goals and time to market goal
- Distinguish different custom designs

- Perform VHDL technique for the analysis, design , and synthesis of digital VLSI systems
- Perform the optimization techniques to the design of digital VLSI systems.

General Skills

- Verify designs using VHDL simulation
- Practice the use of Karnaugh-Maps and finite state machines.
- Estimate delay, power dissipation, and logical effort.
- Practice analysis, design, and synthesis

Course Content

- Review on the design of combinational logic circuits.
- Review on the design of sequential logic circuits.
- Circuit characterization and performance estimation (resistance, capacitance and inductance)
- Circuit characterization and performance estimation (transistor sizing)
- Circuit characterization and performance estimation (transistor sizing)
- Circuit characterization and performance estimation (power dissipation)
- Circuit characterization and performance estimation (design margining)
- Circuit characterization and performance estimation (reliability)
- Design strategies (structured design strategy)
- Design strategies (hierarchy, regularity, modularity, and locality)
- Chip design options (programmable logic structures, programmable interconnects)
- Chip design options (reprogrammable gate arrays)
- Behavioral synthesis, RTL synthesis
- Logic optimization (seminar- individual)
- Project discussion (individual)

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

1- Construction Facility :

Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

2- Academic Support :-

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.

3- Health Care :-

Inside interior clinic of the academy

4- Library Service :-

Membership applications are available at the secretary of the department to meet the needs of the handicapped students.

5- Fundamental programmers of support and care :

Handicapped Students could access Moodle programme to download a copy of the lectures and exercises according to the subjects registered each term. Benches are built for handicapped students by utility and maintenance department under the supervision of Mrs/ Soheir El-Halafawi vice dean of the academy for finance and logistics .

Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement.

Student Assessment

Procedures used:

1. Written Examinations to asses the intended learning outcomes
2. Class Activities (Reports, Discussions, ------) to asses the Intellectual Skills

Schedule:

Weighing of Assessment:

References

- Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, “Digital Integrated Circuits A Design Perspective”, second edition, Pearson Educational international, 2003.
- Wayne Wolf, “Modern VLSI Design: System-on-Chip Design”, third edition, Prentice Hall, 2002.
- R. Jacob Baker, “CMOS Circuit Design, Layout, and Simulation”, third edition A JOHN WILEY & SONS, INC., 2010.
- NeilH.E.Weste, David Harris, ”CMOS VLSI Design A Circuits and Systems Perspective”, third edition, Pearson Education, Inc, 2005.
- Ken Martin, “ Digital Integrated Circuit Design”, Oxford University Press, 2000.

Course Code : **EC 738**

Course Title : **Advanced Electronic Devices**

Credit Hours : **3**

Course Description

Electronic and photonic materials including semiconductors, superconductors, ferroelectrics, liquid crystals, conducting polymers, organic and superconductors, conductors, nonlinear optical and optoelectronic materials, electrochromic materials, laser materials, photoconductors, photovoltaic and electroluminescent materials. Deep knowledge of synthesis, processing, fabrication, spectroscopy, physical properties and applications of electronic and photonic materials in advanced electronic devices covering everything for today's and developing future technologies.

Course Objectives

Acquire deep knowledge of different types, synthesis, processing, fabrication, spectroscopy, physical properties and applications of electronic and photonic materials in advanced electronic devices covering everything for today's and developing future technologies.

Course Topics

- Electronic and photonic materials
- Synthesis, processing, fabrication, spectroscopy, physical properties and applications of electronic and photonic materials

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Understand properties of different types of electronic and photonics materials.
- Understand synthesis processing, fabrication, spectroscopy, physical properties and applications of electronic and photonics materials.
- Understand and design applications of electronic and photonics materials.
- Understand, analyze and design advanced electronic devices covering everything for todays and developing future technologies.

Intellectual Skills

- Apply physical properties of electronic and photonic materials.
- Demonstrate the operation of advanced electronic devices.

Professional Skills

- Design applications of electronic and photonics materials.
- Analyze and design advanced electronic devices covering everything for todays and developing future technologies.

General Skills

- Practice the technology of advanced electronic devices.
- Estimate suitable electronic and photonics materials for different device applications.

Course Content

- Properties of different types of electronic and photonics materials.
- Synthesis, processing, fabrication, spectroscopy, physical properties and applications of electronic and photonics materials.
- Applications of electronic and photonics materials in modern advanced electronic devices.
- Analysis and design advanced electronic devices covering everything for todays and developing future technologies.
- Quantum optoelectronics and nano electronics.

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.

- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Student Assessment:

Procedures used:

- Written examinations.
- Oral examinations.
- Practical examinations.
- Class activities (Assignments, etc…)
- Final

Schedule:

Assessment 1 (7th and 12th Week Written Exam)

Assessment 2 (7th and 12th Week oral Exam)

Assessment 3 (7th and 12th Week practical Exam)

Assessment 4 (continuous assessment)

Assessment 5 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

References

- Hari Singh Nalwa, *Handbook of Advanced Electronic and Photonic Materials and Devices*, Academic Press; 1st ed., 2000

Course Code : **EC 739**

Course Title : **Analog VLSI Design**

Credit Hours : **3**

Course Description

Analog CMOS building blocks, layout design for high performance, and realization of analog arrays. CMOS OpAmp's. A/D and D/A converters. Phase-Locked Loops. Switched-capacitor filters. Neural network realizations. Projects.

Course Objectives

The student should be able to design and analyze Analog Integrated Circuits systems using CMOS technology.

Course Topics

- Analog CMOS Building blocks
- VLSI Layout
- Data converters and electronic filters
- Design for high performance and Design examples

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Describe Analog integrated circuits.
- Estimate and interpret Analog integrated circuits.
- Examine Current sources and sinks
- Describe Reference Circuits.
- Estimate and interpret CMOS Differential Amplifies circuits.
- Estimate and interpret CMOS operational Amplifier circuits.
- Describe Data converter circuits.
- Describe Electronic Filter circuits.

Intellectual Skills

- Demonstrate Analog integrated circuits
- Discover CMOS integrated circuits.
- Discover analog CMOS VLSI circuits.

- Apply DC and AC equivalent circuit of MOSFETS.

Professional Skills

- Analyze and perform Layout of Analog Integrated Circuits
- Analyze analog integrated circuits.
- Design of amplifiers.
- Design of Data converters.
- Design of Electronic Filters.

General Skills

- Practice Circuit analysis techniques.
- The Student should be able to estimate the output of the different amplifiers.
- Propose a VLSI analog circuit design.

Course Content

- Analog MOSFET models.
- Analog CMOS Building blocks.
- VLSI Layout
- Current Sources and sinks.
- References.
- Amplifiers and Feedback Amplifiers
- Differential Amplifiers
- Operational Amplifiers.
- Nonlinear Analog circuits.
- Data converters and electronic filters.
- Design for high performance.

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets

- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Academic Support:

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.

Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

1. Written Examinations
2. Oral Examinations
3. Practical Examinations

4. Class Activities (Assigmnents, etc)

5. Final

Schedule:

Assessment 1 (7th and 12th Week Written Exam)

Assessment 2 (7th and 12th Week oral Exam)

Assessment 3 (7th and 12th Week practical Exam)

Assessment 4 (continuous assessment)

Assessment 5 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

References

- P. Allen and D. Holberg, *CMOS Analog Circuit Design*, 2nd Ed., 2002.
- P.R.Gray, R.G.Meyer, *Analysis and Design of Analog Integrated Circuits*.
- R. Gregordean and D. Temes, *Analog MOS Integrated Circuits for Signal Processing***.**
- N. Weste and K. Eshraghian, *Principles of CMOS VLSI Design*, 2nd Ed.
- L. Glaser and D. Dobberpuhl, *The Design and Analysis of VLSI Circuits*.
- Selected papers

Course Code : **EC740**

Course Title : **Computer-Aided Design for Electronic Circuits**

Credit Hours : **3**

Course Description

Understanding and applications on MEMES

Course Objectives

The objectives of the course are to provide the students with strong foundation on MEMS technology and application in real life and related topics.

Course Topics

- Introduction to MEMS material.
- Techniques For Actuation And Sensing.
- MEMS Sensors.
- MEMS Actuator & Pull-In Instability.
- Parallel Plate Electrostatic Actuator Modeling & Simulation.
- Comb-Drive Actuator Modeling & Simulation.
- Micro Resonator Modeling & Simulation.
- Micro Engine Modeling & Simulation
- Practical issues and implementation.
- RF MEMS Enabled Circuit Elements and Models
- MEM Structures and Systems in Industrial and Automotive Applications

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- The students should be able to:
- Label the main characteristics of electronic design
- Know and understand mixed mode circuit representation and simulation techniques.
- Tabulate static and dynamic analysis tools.
- Describe design environments including simulation and synthesis tools.
- Associate designs with testability.

- Summarize computer-aided design and optimization techniques.

Intellectual Skills

The student should be able to:

- Apply analysis, design and synthesis tools for digital, analog, and mixed electronic circuits.
- Demonstrate various design environments.
- Select suitable computer-aided design and optimization techniques.

Professional Skills

The student should be able to:

- Distinguish different simulation techniques used in analog, digital, and mixed analog digital electronic circuits.
- Classify static and dynamic analysis tools.
- Perform event-driven and gate level simulations.
- Apply VHDL technique for the analysis, design , and synthesis of digital, analog, and mixed analog digital systems
- Differentiate between the optimization techniques used in the computer aided design

General Skills

- Practice timing analysis and simulation
- Label fault detection and diagnosis
- Estimate worst case delay, and layout dependent delay.
- Propose built in self test
- Verify observability, controllability, and scan paths

Course Content

- Characteristics of digital electronic design.
- Design process and flow-22-VHDL modeling, synthesis, and verification.
- Representation and simulation techniques of electronic systems.
- Analog, Digital, and mixed analog digital simulation.
- Static Analysis tools

- Dynamic analysis tools
- Technology mapping
- Logic and fault simulation
- Design for testability
- Test generation strategy
- Murphy's law for testing
- Test generation by evolution and search
- Single fault single test generation
- Design environments.
- Timing analysis and simulation.

Teaching and Learning Methods

- Lectures
- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

Handicapped Students should be informed that the Electronics and Communications department presents facilities that support education embedded in the following:-

1- Construction Facility :

Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

2- Academic Support :-

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.

3- Health Care :-

Inside interior clinic of the academy

4- Library Service :-

Membership applications are available at the secretary of the department to meet the needs of the handicapped students.

5- Fundamental programmers of support and care :

Handicapped Students could access Moodle programme to download a copy of the lectures and exercises according to the subjects registered each term. Benches are built for handicapped students by utility and maintenance department under the supervision of Mrs/ Soheir Elhalafawi vice dean of the

academy for finance and logistics.
Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement.

Student Assessment:

Procedures used:

Written Examinations to assess The Intended Learning Outcomes Class Activities (Reports, Discussions, ------) to assess The Intellectual Skills

Schedule:

Assessment 1	7th Week Written Exam
Assessment 2	12th Week Written Exam
Assessment 3	Continuous Assessments
Assessment 4	16th Week Final Written Exam

Weighing of Assessment:

7th Week Examination	30 %
12th Week Examination	20 %
Final-term Examination	40 %
Seminar+ project	10 %
Total	100%

References

1-Fredrik-J-Hill, Jerald R-Peterson, "Computer Aided Logical Design with Emphasis on VLSI ", 4th Edition, Hill Peterson.
2-Steven M. Rubin, "Computer Aids for VLSI Design", 2nd Edition, 1998.

Course Code : **EC741**
Course Title : **Advanced Topics in MEMS**

Credit Hours : **3**

Course Description

Understanding and applications on MEMES

Course Objectives

The objectives of the course are to provide the students with strong foundation on MEMS technology and application in real life and related topics.

Course Topics

- Introduction to MEMS material.
- Techniques For Actuation And Sensing.

- MEMS Sensors.
- MEMS Actuator & Pull-In Instability.
- Parallel Plate Electrostatic Actuator Modeling & Simulation.
- Comb-Drive Actuator Modeling & Simulation.
- Micro Resonator Modeling & Simulation.
- Micro Engine Modeling & Simulation
- Practical issues and implementation.
- RF MEMS Enabled Circuit Elements and Models
- MEM Structures and Systems in Industrial and Automotive Applications

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Identification of the MEMS technology
- Knowledge and understanding of different types of MEMS
- Familiarization with microsensors, and microacuators
- Experimenting with piezoelectricity and piezoresistivity
- Knowledge of the manufacturing technology of MEMS
- Differentiate between different types
- Know the manufacturing technology and the resources
- Adapt him/herself with the use of microsensors and actuators

Intellectual Skills

- Apply the basic knowledge of MEMS to understand the operation of circuits containing MEMS
- Classify different types of MEMS and the enhancement they introduce to the system performance
- Determine the features of each type of microsensors and actuators used in MEMS applications
- Simulate the operation of MEMS using computer software
- Organize design tasks into structured forms

Professional Skills

- Differentiate between different types of MEMS

- Explain appropriate specifications for required microsensors and microacuators
- Synthesize and integrate MEMS based electronic systems

General Skills

- Search for information and adopt life- long self learning
- Gain an experience in the operation, design and assembly of the robots

Course Content

- MEMS technology, revolution and advantages
- Description of MEMS, applications
- MEMs fabrication techniques
- Nature of the piezoelectricity and piezoresistivity and their applications in the microsensors
- The MEMS inductor and capacitors
- Identification of the microsensors, microacuators
- The scaling effects
- The microassembly
- Microrobotics

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Construction Facility:

Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

Academic Support:

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.

Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

- Written Exams
- Oral Exams
- Class activities
- Seminars

Schedule:

Assessment 1	7th Week Written Exam
Assessment 2	12th Week Written Exam
Assessment 3	Continuous Assessments
Assessment 4	16th Week Final Written Exam

Weighing of Assessment:

7th Week Examination	30 %
12th Week Examination	20 %
Final-term Examination	40 %
Semester Work	10 %
Total	100%

References

1.V. K. Varadan, K.J. Vinoy, “RF MEMS and Their Applications”, 2003.
2. S. Beeby, G. Ensell, M. Kraft, N. White, “MEMS Mechanical Sensors”, British Library 2004.

3. J.D. Santo “RF MEMS Circuit Design For Wireless Communications”, 2008.

Course Code : **EC 742**

Course Title : **Microwave Antennas Systems**

Credit Hours : **3**

Course Description

Uniform and Non-Uniform illuminated apertures. Horn, slot and microstrip antennas. Curved Surface reflector antennas. Doubly curved surface reflector antennas. Ray optics, asymptotic techniques, and lens antennas. Non-uniformly feed arrays. Array synthesis techniques. Engineering mathematics (Matrices, QR Decomposition, and Gaussian Elimination). Phased arrays, non-uniform arrays, adaptive arrays and beam forming, signal processing arrays.

Course Objectives

The student should be able to design the following types of antennas:

- Wide band Antennas
- Microstrip patches
- Adaptive Antennas

Course Topics

- Aperture Antennas
- Horn Antenna
- Surface Reflector Antennas
- Slot and Microstrip Antennas
- Non-uniformly Feed Arrays
- Engineering Mathematics
- Phased Arrays
- Adaptive Arrays and Beam Forming

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

Students will be able to:

- Tell knowledge and understanding of antenna and wave propagation.
- Summerize of basic electromagnetic theory including Maxwell's equations and the wave equation and differential and integral calculus.
- List the fundamental principles of antenna theory to the analysis, design and Measurements of broadband and frequency-independent antennas, microstrip patches, and adaptive antennas.
- Tell the knowledge and understanding of microwave applications.

Intellectual Skills

The student will acquire high skills and an ability to:

- Report and construct almost any antenna configuration using the introductory material on analytical methods, such as Fourier transform technique, with the fundamental principles of antenna theory.
- Discover and calculate the most basic antenna characteristics (pattern, gain, directivity, radiation efficiency, impedance, current, and polarization).
- Construct computer programs.
- Detect, classify and modify data and apply experiments to obtain new data.

Professional Skills

By the end of the course the student will have the ability to:

- Perform sufficient mathematical skills to follow, the flow of analysis and design of any antenna configuration
- Manipulate FORTRAN computer programs, Numerical Electromagnetic Code (NEC), and HFSS program for analyzing and designing antennas.
- Design a computer code to solve problems.
- Select appropriate tools to measure system performance.
- Analyze, design and perform a system.
- Differentiate appropriate analysis and design tools.
- Experiment relevant laboratory equipment and analyze the results.

General Skills

Students will be able to:

- Practice experience and facility in systematic approaches to solve problems.
- Communicate effectively, both orally and in writing.

Course Content

- Aperture Antennas
- Horn Antenna
- Surface Reflector Antennas
- Slot and Microstrip Antennas
- Non-uniformly Feed Arrays
- Engineering Mathematics
- Phased Arrays
- Adaptive Arrays and Beam Forming

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Academic Support:

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.

Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

1- Written exams
2- Assignments
3- Discussions

Schedule:

Assessment 1 (7th and 12th Week Written Exam)
Assessment 2 (7th and 12th Week oral Exam)
Assessment 3 (continuous assessment)
Assessment 4 (16th week Final Exam)

Weighing of Assessment:

Mid-term exams	50%
Semester work	10%
Final term exam	40%
Total	100%

References

- Milligan, T.A. *Modern Design*, McGraw-Hill, 1981.
- Monzing, R. and T., *Introduction to Adaptive* Arrays, Wiley
- J. Bahl and P. Bhatia, "*Microstrip Antennas*", Artech House, INC., Massachusetts 1980.
- Simon Haykin, "*Adaptive Filter Theory*", 2nd edition.

Course Code : **EC 743**

Course Title : **Antennas for Mobile Communications**

Credit Hours : **3**

Course Description

Fundamental parameters of antennas, Linear wire antennas, Helical antenna, Inverted F-antenna, Log periodic antenna, Conical and Biconical antennas, and Slotted waveguide.

Course Objectives

- To introduce the students to the basics of antennas.
- Students should be versed in the different types of antennas that are used for mobile communications.

Course Topics

- Fundamental parameters of antennas
- Linear wire antennas
- Helical antenna
- Inverted F-antenna
- Log periodic antenna
- Conical and Biconical antennas
- Planar Inverted F-antenna
- Slotted waveguide

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

Students will be able to define:

- The basic knowledge, concepts of mathematics, sciences and engineering principles to communication system, accuracy 80 %
- The microstrip antenna of rectangular configurations basic radiation principles of antennas using 1 case report.
- The microstrip antenna of rectangular configurations basic radiation principles of antennas using 1 case report.
- The microstrip antenna of rectangular configurations basic radiation principles of antennas using 1 case report.
- The micro strip antenna of circular configurations basic radiation principles of

antennas using 1 case report.

- The micro strip antenna of circular configurations basic radiation principles of antennas using 1 case report.
- To describe various types of antennas based on their performance using a case study written report.
- To examine the knowledge and understanding of antennas and wave propagation using a group project.
- To identify antennas for various practical applications using student seminar.
- To define helical and inverted F antennas using 1 assignment.
- To describe antennas using as assignment and a written exam.
- To describe log periodic antennas using an assignment and a written report.
- To describe the concept of smart antennas using an oral group project.

Intellectual Skills

- Students will be able to demonstrate, calculate data and apply experiments to obtain new data using 2 design assignments.
- Students will be able to examine computer programs using 1 single matlab program.
- Student will be able to demonstrate the learning to plot 3D patterns of various antennas using 2 assignments.
- Student will be able to demonstrate the learning to simulate various antenna performances using a NEC simulating program.

Professional Skills

- Students will be able to analyze a computer to solve problems using matlab program.
- Students will be able to select appropriate tools to measure system performance.
- Student will be able to analyze the learning to measure the HPBW of various antennas using a written exam and 2 assignments.
- The student will be able to experiment a FORTRAN computer programs and Numerical Electromagnetic Code (NEC) for analyzing and designing antennas using a written report.
- Students will be able to analyze, compare, and design a system using a professional discussion.
- Students will be able to distinguish relevant laboratory equipment and analyze the results correctly using a written report.

General Skills

- The students will able to comply experience and facility in systematic approaches to solve problems with efficiency 80 %.
- Student will be able to comply the performance of various antennas using a simulation tool.
- The students will be able to communicate effectively, both orally and in writing using a case written report.

Course Content

1. Fundamental Parameters of Antennas.
2. Introduction to Microstrip Antennas (Definition, Advantages,
3. Rectangular Microstrip Antennas (Analysis of a Rectangular Patch – Transmission Line Method- Radiation Pattern-Directivity, Radiation.
4. Design procedures for rectangular Microstrip Antennas - Compact Rectangular Patch (/ Quarter – Wave Rectangular Patch)
5. Circular Microstrip Antennas (Analysis of a Circular disk Antenna Using Cavity Model- Radiation Pattern-Directivity, Radiation Resistance)
6. Design procedures for Circular Microstrip Antennas – Small Circular Microstrip Antennas
7. 7th week exam
8. Wideband Antenna (Spiral, Conical, and Cylinderical Antennas.
9. Wideband Antenna (Spiral, Conical, and Cylinderical Antennas.
10. Helical (Normal And Axial Mode), Inverted F Antennas, and Planar F antenna.
11. Helical (Normal And Axial Mode), Inverted F Antennas, and Planar F antenna.
12. 12th week exam.
13. Log Periodic, and Lens Antennas (analysis and design)
14. Student Presentation.
15. Student Presentation.
16. Final examination.

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories

- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Academic Support:

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.

Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

1- Quizzes to assess the understanding of theoretical principles

2- Assignments to assess students ability to practically imply theoretical principles

3- HFSS assignments to assess the level understanding of the software

4- A project to assess overall understanding of the course

Schedule:

Assessment 1 (7th and 12th Week Written Exam)
Assessment 2 (7th and 12th Week oral Exam)
Assessment 3 (7th and 12th Week practical Exam)
Assessment 4 (continuous assessment)
Assessment 5 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

References

- I. J. Bahl, P. Bhatia, "*Microstrip Antennas*", Artech House.
- Constantine A. Balanis, "*Antenna Theory, Analysis and Design*", 2nd ed., Wiley

Course Code : **EC 744**

Course Title : **Wireless Communications**

Credit Hours : **3**

Course Description

This course covers the fundamental issues impacting all wireless communications and reviews virtually most of the important new wireless standard and technological development. Comprehensive coverage of the spread spectrum multiple access techniques and its applications in 2G and 3G mobile systems and wireless local area networks (WLAN) and satellite networks.

Course Objectives

The student should be familiar with the fundamental treatment about many practical and theoretical concepts that form the basis of modern wireless communication systems. Also, be familiar up to the minute technical details of the many emerging wireless standards throughout the world.

Course Topics

- Introduction to Digital Wireless RF Communications: Historical background
- Frequency allocations, Examples of wireless and Personal communications Systems
- Basic Concepts in Radio wave Propagation, Wireless system components
- Source coding, channel coding, interleaving, Digital modulation techniques for Mobile Radio
- Multiple Access and Spread Spectrum Techniques
- Code Division Multiple Access technique
- Multi-carrier CDMA and OFDM, MIMO-OFDM
- Mobile Radio Propagation, path loss, small-scale fading, multipath, spatial temporal channel
- The Cellular Radio Concept
- Second Generation (2G) cellular networks (IS95) and GPRS
- Third Generation (3G) Wireless Networks: WCDMA, CDMA2000 and EDGE
- Bluetooth and Personal Area Networks (PANs)
- New3 WLAN technologies: IEEE 802.11 a, b, and g standards, HIPERLAN, WIMAX
- UWB, Fixed wireless and Local Multipoint Distribution Services (LMDS), DECT systems

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Identify the main characteristics of wireless communications.
- Describe the concept of frequency allocations.
- Show the difference between personal and other types of wireless communications
- Describe various propagation mechanisms
- Identify different source and channel coding techniques
- Identify the interleaving procedures
- Show the different between digital and analog modulation methods.
- Describe the different modulation schemes used in wireless communications.
- Describe block diagram of multiple access mechanism
- Describe the spread spectrum techniques.
- Show the difference between different codes used in code division multiple accesses.
- Explain the orthogonality and FFT concept.
- Describe MIMO systems
- Explain concept of cellular geometry and the different generations of cellular technologies.
- Explain concept of next generations of cellular technologies.
- Describe the architecture of WLAN and the standard based on it.
- Describe the architecture of UWB and the standard based on it.

Intellectual Skills

- Examine reception in different radio propagation.
- Examine reception with source coding and channel coding.
- Examine reception in of OFDM systems.

Professional Skills

- Design wireless systems with the concept of frequency allocations.
- Compare receiver performance in different radio propagation.
- Compare receiver performance with source, channel coding and interleaver.

- Compare receiver performance with different modulations
- Distinguish between orthogonal and pseudorandom codes
- Compare receiver performance using OFDM in wireless channels.

General Skills

- Practice on literature review
- Practice on presentation skills.
- Practice on writing skills
- Label submission for the project
- Practice on writing research report.
- Practice on research presentation.
- Qualify new trends in cellular technology.
- Practice on communication skills

Course Content

- Introduction to Digital wireless RF communications.
- Frequency allocations, Examples of wireless and Personal communications Systems
- Basic Concepts in Radio wave Propagation, Wireless system components
- Source coding, channel coding, interleaving,
- Digital modulation techniques for Mobile Radio
- Multiple Access and Spread Spectrum Techniques
- Code Division Multiple Access technique
- OFDM, MIMO_OFDM
- The Cellular Radio Concept
- Second Generation (2G) cellular networks (IS95) and GPRS
- Third Generation (3G) Wireless Networks: WCDMA, CDMA2000 and EDGE
- Bluetooth and Personal Area Networks (PANs)
- New WLAN technologies: IEEE 802.11 a, b, and g standards, HIPERLAN, WIMAX
- UWB, Fixed wireless and Local Multipoint Distribution Services (LMDS), DECT systems
- Student presentation

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

Construction Facility:
Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

Academic Support:
Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

5. Written Examinations to asses the intended learning outcomes
6. Class Activities (Reports, Discussions, ------) to asses the Intellectual Skills

Schedule:

Assessment 1	7th Week Written Exam
Assessment 2	12th Week Written Exam
Assessment 3	Report and Presentation
Assessment 4	Exam

Weighing of Assessment:

7th Week Examination	20 %
12th Week Examination	20 %
Final-term Examination	40 %
Oral Examination	0 %
Practical Examination	0 %
Semester Work	20 %
Total	100%

References

- Theodore Rappaport, "*Wireless Communications: Principles and Practice*", 2nd Edition, Prentice Hall PTR, 2002. (0-13-042232-0)

- Simon Haykin, "*Communication Systems*", 2nd Edition, Wiley, 1994. (0-741-57178-8)

Course Code : **EC 745**

Course Title : **Telecommunication Networks**

Credit Hours : **3**

Course Description

This course covers these topics: Motivations and objectives of computer networks; overview of layered architecture and the ISO Reference Model; network functions, circuit-switching and packet-switching; physical level protocols; data link protocols including HDLC and multi-access link control. Network control, transport, and session protocols including routing flow control; end-to-end communication and inter-networking. Presentation layer protocols including web, virtual terminal and file transfer protocols, cryptography, and text compression. It also introduces some important merging technologies, such as, integrated voice and data networks (VOIP) and the integration of wireless and wired networks. Specific examples and standards will be cited throughout the course.

Course Objectives

The student should be familiar with the fundamental concepts of networking and how network is modeled from the physical layer up to the transport layer. Also, he will be familiar with how these layers are implemented in LAN, WLAN and cellular networks.

Course Topics

- OSI and TCP/IP models
- Switching techniques
- Physical layer
- MAC layer
- Network layer
- Transport layer
- LAN, cellular and WLAN as network models

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Identify the importance of cellular communications
- List different parameters that are used in mobility management
- Describe the interaction between the different modules in the GSM handover
- Define the notion of air interface
- Explain the different types of classes used in GPRS systems

- Define the notion of GPRS services
- distinguish the difference between GSM and GPRS
- Describe CDMA technology
- distinguish the difference between 2G and 3G
- Know the reason for developing UMTS
- Define the standards of mobility in UMTS
- distinguish the difference between HSDPA and HSUPA
- List different parameters that are used in WLAN
- Describe the MAC used in such networks
- List different parameters that are used in this networks
- Describe the MAC used in such networks
- Define the models of security used in networking
- Explain the difference and mode of operation of such models
- Define the notion of QoS and priorities
- Explain the different types of classes and methods used in QoS
- Define the notion of TCP/IP and addressing
- Explain the difference between TCP and UDP
- Identify the direction of research in network
- Show the importance of networking in other fields of engineering
- Explain the concept of VOIP
- Identify the direction of research in network
- Show the importance of networking in other fields of engineering
- Identify the direction of research in network
- Show the importance of networking in other fields of engineering

Intellectual Skills

- Calculate the range of rates in each class
- Report the new trends used in cellular technology such as EDGE
- Report the new communication techniques used in UMTS
- Relate the security mechanisms to the layer architecture of networking
- Demonstrate the difference between TCP and UDP

Professional Skills

- Analyze the different communications techniques used in mobility management
- Compare between these communication techniques
- Design GPRS networks
- Experiment this in a simulating software
- Experiment this in a simulating software
- Analyze the different communications techniques used in WLAN
- Compare between these communication techniques
- Analyze the different communications techniques used in this layer
- Compare between these communication techniques
- Design QoS networks
- Analyze TCP networks
- Simulate the VOIP

General Skills

- Verify theory with practice
- Communicate with other students and discussion groups

Course Content

- GSM - Mobility Management and Call Control –
- The GPRS Air Interface - GPRS Radio Resource Management.
- UMTS - CDMA - UMTS Channel Structure on the Air Interface - The UMTS Terrestrial Radio Access Network (UTRAN).
- The MAC Layer - The Physical Layer of Wireless LAN
- 802.16 and WiMAX
- QoS in telecommunication systems
- IP networking
- Multimedia networking - Internet Protocol Version 4 (IPv4) - Internet Protocol Version 6 (IPv6) - Multicast Support.
- Internet Telephony
- Resource allocation and management
- Sensor networks

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Construction Facility:
Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

Academic Support:
Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

1. Written Examinations to asses the intended learning outcomes
2. Class Activities (Reports, Discussions, ------) to asses the Intellectual Skills

Schedule:

Assessment 1	7th Week Written Exam
Assessment 2	12th Week Written Exam
Assessment 3	Continuous Assessments
Assessment 4	16th Week Final Written Exam

Weighing of Assessment:

7th Week Examination	30 %
12th Week Examination	20 %
Final-term Examination	40 %
Oral Examination	0 %
Practical Examination	0 %
Semester Work	10 %
Total	100%

References

- According to material contents and simulation tools

Course Code : **EC 746**

Course Title : **Mobile Data Management**

Credit Hours : **3**

Course Description

The course covers emerging topics in database systems and related technologies. Hands-on experience is gained through an emerging technology-driven semester long project in the field of mobile and wireless communications.

Course Objectives

The student should be familiar with the fundamental concepts of mobile networking and mobile data management. Also, (s)he will be familiar with how data is stored, retrieved, replicated and updated.

Course Topics

- Overview of emerging database applications and challenges
- Mobile Database Management
- Mobile Location based Services
- Spatial Indexing Techniques
- Data Clustering Algorithms
- Stream databases
- Data Mining and Privacy Preserving Data Mining
- Web Search and Web IR
- Role based Access Control
- Data Warehouse and OLAP
- RFID data management
- Workflow Management

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Define at least two emerging database applications and challenges for mobile data management
- Explain the idea and theory behind Mobile Database Management
- Explain the different types of Mobile Database Management

Intellectual Skills

- Show different Spatial Indexing Techniques
- Apply MDM in location based service
- Apply Data clustering algorithm in MDM

Professional Skills

- Distinguish between Web Search and Web IR
- Analyze Role based Access Control
- Design Stream databases
- Analysis RFID data management
- Design Workflow Management

General Skills

- Verify by Case studies Data Mining and Privacy Preserving Data Mining
- Propose presentation on new topics in MDM

Course Content

- Overview of emerging database applications and challenges
- Mobile Database Management
- Mobile Location based Services
- Spatial Indexing Techniques
- Data Clustering Algorithms
- Stream databases
- Data Mining and Privacy Preserving Data Mining
- Web Search and Web IR
- Role based Access Control
- Data Warehouse and OLAP
- RFID data management
- Workflow Management
- Student presentations

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Academic Support:

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.

Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

1. Written Examinations
2. Presentations
3. Class Activities (Assignments, etc ------)
4. Final Examination

Schedule:

Assessment 1 (7th and 12th Week Written Exam)
Assessment 2 (according to presentations time table)
Assessment 3 (continuous assessment)
Assessment 4 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	20%
Assessment 3	10%
Assessment 4	40%
Total	100%

References

- According to material contents and simulation tools

Course Code : **EC 747**

Course Title : **Advanced Digital Image Processing**

Credit Hours : **3**

Course Description

Introduction to Human Visual System, digital image sensing and basic operations on digital images. 2D Systems: 2D spatial and frequency domain operations. Image Restoration. Image Transforms. Image coding and compression. Multi-resolution coding, subbands and wavelets. Low-level image analysis: edge detection and segmentation. Image watermarking. Non-linear Image Processing. Applications of non-linear filters in image enhancement, edge detections, and noise removal.

Course Objectives

Students should become familiar with image filtration, transform, and analysis methods. Also, students should become able to deal with various image enhancement and restoration techniques. Furthermore, students will gain knowledge about other related topics such as image watermarking and image coding.

Course Topics

- Image acquisition
- Image filtration
- Image transforms
- Image coding
- Image analysis
- Image watermarking

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Show general introduction for the course contents, and overview on image processing
- Show image acquisition and handling fundamentals
- Describe at least three types of transforms used in image preprocessing including FFT, DCT, and Wavelet transforms.
- Describe Spatial and transform domains filtration.
- Explain two methods for image filtration using examples.
- Define and show edge detection techniques
- Explain at least three different techniques used to enhance images

- Show at least two image restoration techniques
- Explain image segmentation methods
- Identify the differences between the various color systems
- Describe morphological image processing
- Show two image compression methods.
- Describe JPEG and JPEG2000 systems.
- Describe at least two methods for image watermarking
- Show non-linear image processing with at least two applications

Intellectual Skills

- Determine the importance of at least two image filtration methods
- Experiment edge detection methods
- Explain image restoration techniques by examples
- Demonstrate image enhancement techniques
- Demonstrate Image processing using different color systems
- Demonstrate image watermarking using at least two techniques

Professional Skills

- Manipulate image processing using Matlab toolbox for image processing
- Experiment at least three different transforms on images using Matlab
- Design at least two algorithms used for image filtration using Matlab
- Explain edge detection algorithms using Matlab
- Perform at least two image enhancement using Matlab.
- Design algorithms for image segmentation
- Experiment various color systems on images using matlab
- Perform morphological processing using Matlab
- Explain image compression algorithms using examples
- Perform at least two non-linear image processing using Matlab

General Skills

- Estimate the importance of at least two image filtration methods
- Practice edge detection algorithms using Matlab
- Verify at least two algorithms used for image restoration using Matlab

- Practice image processing using different color systems
- Estimate image compression versus image quality using Matlab

Course Content

- Introduction to Image Processing
- Digital Image fundamentals
- Image Transforms
- Image Filtration
- Edge detection
- Image restoration & Enchantement
- Image segmentation
- Color Image Processing
- Morphological image processing
- Image compression
- Image Watermarking
- Non-linear image processing

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Construction Facility:
Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

Academic Support:
Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

1. Written Exams
2. Oral exams
3. Class activities

4. Projects
5. Reports
6. Seminars

Schedule:

Assessment 1	7th Week Written Exam
Assessment 2	12th Week Written Exam
Assessment 3	Continuous Assessments
Assessment 4	16th Week Final Written Exam

Weighing of Assessment:

7th Week Examination	30 %
12th Week Examination	20 %
Final-term Examination	40 %
Seminar+ project	10 %
Total	100%

References

- Anil K. Jain, *Fundamentals of Digital Image Processing*, Prentice Hall.
- R. C. Gonzalez and R. E. Woods, *Digital Image Processing*, Prentice Hall.

Course Code : **EC 748**
Course Title : **Multimedia Communications Systems**

Credit Hours : **3**

Course Description

Multimedia Communication Model, Elements of Multimedia Systems, Digital Media. Challenges of Multimedia Information Processing. Audio Coding for Multimedia Applications. Image Coding. Video Coding. Watermarking. Signal Processing for Networked Multimedia. MPEG Approach to Multimedia Standardization: MPEG-1, MPEG-2, and MPEG-4 coding systems. JPEG and JPEG 2000 Image Compression Standards. MPEG-7 Systems. MPEG-21 Multimedia Framework. ITU-T Standardization of Audiovisual Communication Systems. Multimedia across IP Networks. MPEG Video Transmission on the Internet. Video Coding for Multimedia across IP. Multimedia across Wireless. Speech Transmission in GSM. Video across GSM. Wireless Multimedia Delivery. Digital Video Broadcasting (DVB). Broadband Multimedia Satellite Systems.

Course Objectives

To gain knowledge in this important area. The comprehensive information presented during the course should serve as a valuable resource to multimedia communications systems. Students should become familiar with multimedia communication standards such as MPEG and ITU standards, as well as understand transmission of multimedia through various communication networks.

Course Topics

- Multimedia communications
- Multimedia processing in communications
- Multimedia communication standards
- Multimedia communications across networks

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Show elements and model for Multimedia Communication systems.
- Explain Digital Media.
- Show challenges of Multimedia Information Processing.
- Describe at least two audio coding methods.
- Explain at least two techniques for image and video compression techniques.
- Show watermarking methods with at least two examples.

- Explain at least three methods for signal processing used in networked multimedia.
- Explain JPEG and .TPEG-2000 image compression systems
- Explain IVIPEG-I,-2, and -4 video compression standards.
- Show details for MPEG-7 standard.
- Show details for MPEG-2 1 framework.
- Describe at least three ITU standards for audio and video transmission over communication systems.
- Describe Video Transmission over the Internet.
- Describe Speech Transmission in GSM.
- Show Video across GSM.
- Explain Wireless Multimedia Delivery.
- Show at least two Digital Video Broadcasting (DVB) standards.
- Describe at least one Broadband Multimedia Satellite system.

Intellectual Skills

- Show elements and model for Multimedia Communication systems.
- Explain Digital Media.
- Show challenges of Multimedia Information Processing.
- Describe at least two audio coding methods.
- Explain at least two techniques for image and video compression techniques.
- Show watermarking methods with at least two examples.
- Explain at least three methods for signal processing used in networked multimedia.
- Explain JPEG and .TPEG-2000 image compression systems
- Explain IVIPEG-I,-2, and -4 video compression standards.
- Show details for MPEG-7 standard.
- Show details for MPEG-2 1 framework.
- Describe at least three ITU standards for audio and video transmission over communication systems.
- Describe Video Transmission over the Internet.
- Describe Speech Transmission in GSM.
- Show Video across GSM.

- Explain Wireless Multimedia Delivery.
- Show at least two Digital Video Broadcasting (DVB) standards.
- Describe at least one Broadband Multimedia Satellite system.

Professional Skills

- Manipulate audio signals using Matlab
- Estimate image compression versus image quality using Matlab
- Design at least one image denoising method using matlab.
- Manipulate image compression using Matlab toolbox for image processing

General Skills

- Label image compression algorithms using examples
- Verify differences between MPEG & ITU coding systems.
- Estimate the importance of manipulating multimedia over wireless network.

Course Content

- Multimedia Communication Model
- Audio Coding for Multimedia Applications.
- Image & Video Coding.
- Watermarking.
- Signal Processing for Networked Multimedia.
- JPEG and JPEG 2000 Image Compression Standards.
- MPEG Approach to Multimedia Standardization: MPEG1, MPEG-2, and MPEG-4 coding systems.
- MPEG-7 Systems.
- MPEG-2 1 Multimedia Framework.
- ITU-T Standardization of Audiovisual Communication Systems
- Multimedia across IP Networks.
- Multimedia across Wireless Network.
- Digital Video Broadcasting (DVB).
- Broadband Multimedia Satellite Systems.

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Academic Support:

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.

Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

Written Examinations

Oral Examinations

Practical Examinations

Class Activities (Assignments, etc ------)

Final Examination

Schedule:

Assessment 1 (7th and 12th Week Written Exam)

Assessment 2 (7th and 12th Week oral Exam)

Assessment 3 (7th and 12th Week practical Exam)

Assessment 4 (continuous assessment)

Assessment 5 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

References

- K. R. Rao, Zoran S. Bojkovic, Dragorad A. Milovanovic, *Multimedia Communication Systems: Techniques, Standards, and Networks*, Prentice Hall, 2002.

Course Code : **EC 749**

Course Title : **Computer-Aided Design of Communication Systems**

Credit Hours : **3**

Course Description

This course covers simulation techniques for communication systems operating in random environments. Simulation models for stochastic signals and system components including coders, decoders, modulators, nonlinear amplifiers, bit and

carrier synchronizers, equalizers and receivers. Techniques for modeling time-varying channels. Monte Carlo simulation, semi-analytic simulation and variance reduction techniques applied to the analysis, design and performance evaluation of communication systems.

Course Objectives

The aim of this course is to introduce a fundamental topics in computer-aided design for Logic synthesis and formal verification, timing analysis and optimization, technology mapping, logic and fault simulation, testing, design algorithm and fault tolerant computing will be covered.

Lecture Syllabus

- Characteristics of Digital Electronic Design
- Mixed-Mode Circuit Representation and Simulation technique
- Static Analysis Tools
- Design Environments
- Synthesis Tools
- Dynamic Analysis Tools
- Design for Testability
- Computer Aided Design and Optimization

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Understand Simulation Methodologies (Motivation, basic techniques) through usage of flowcharts and pseudo code.
- Label Digital Communication System Concepts such as modulation, ML and MAP receivers, signal space, Euclidean distance and error probability, union bound
- Tell the process of Filter Models and Efficient Simulation Techniques such as IIR and FIR structures, discrete integration, the bi-linear z-transform, noise bandwidth of discrete-time structures
- Know the difference between PSD and auto-correlation using Fourier transform
- Distinguish between the response of LTIS to RS, WGN, NWGN using equations

Intellectual Skills

- Calculate the, correlation between samples using examples
- Demonstrate Noise Generation and Modeling (Congruence algorithms, PN sequence generators, testing uniform number generators, mapping to target probability density functions, mapping to target power spectral densities)
- Apply Fundamentals of Monte Carlo Estimation (Parameter estimation, point and interval estimates, biased and un-biased estimates, consistent estimates)
- Examine the stationarity of R.S using at least two examples
- Examine the Ergodicity of a stationary of R.S using at least two examples
- Calculate the SNR for at least three scenarios
- Calculate the SNR expression for DSB-TC using coherent detector
- Calculate SNR expression for Rayliegh and Ricean distribution

Professional Skills

- Use of MATLAB program to design and analyze communications systems.
- Analyze different sampling approaches
- Use the graphical results to analyze data and make decisions.
- Analyze the response of LTI system to at least two random signals
- Explain SNR for coherent detection using Matlab simulation
- Analyze the DSB-SC , QDSB, and SSB using coherent detector in presence of noise
- Analyze Digital modulation techniques using coherent detector in presence of noise
- Analyze Digital modulation techniques using non- coherent detector in presence of noise
- Analyze Digital modulation techniques using non-coherent detector in presence of fading channels

General Skills

- Practice generating a R.V. and Random signal using Matlab simulation
- Practice Transformation of RV's using Matlab simulation

- Follow simulation process and increase skills of validating system behavior.
- Communicate effectively as exhibited by scoring 8 out 10 points for all the components within the grading criteria on the final writing assignment.

Course Content

- Introduction to Simulation Methodologies
- Review of Digital Communication System Concepts (Basic modulation, ML and MAP receivers, signal space, Euclidean distance and error probability, union bound)
- Sampling, Pulse Shaping and Discrete System Theory (Sampling, ailiasing and finite wordlength effects, the z-transform and discrete system theory)
- Filter Models and Efficient Simulation Techniques (IIR and FIR structures, discrete integration, the bi-linear z-transform, noise bandwidth of discrete-time structures)
- Signal and System Representations (Hilbert transforms, analytic signals, complex envelopes, direct/quadrature representations of systems, direct/quadrature representations of random bandpass signals, simulation structures of bandpass systems)
- A Noiseless Case Study — The Phase Locked Loop(PLL architectures, component models, modeling errors and approximations, performance characterization for both tracking (linear) and acquisition (non-linear) operation)
- Noise Generation and Modeling (Congruence algorithms, PN sequence generators, testing uniform number generators, mapping to target probability density functions, mapping to target power spectral densities)
- Graphical Simulation Products (Signal constellations, D/Q signal plots and eye diagrams, phase-plane plots, probability density function estimation and histograms, power spectral density estimation)
- Fundamentals of Monte Carlo Estimation (Parameter estimation, point and interval estimates, biased and un-biased estimates, consistent estimates)
- Monte Carlo Simulation of Communication Systems (Binary systems, M-ary systems, simulation architecture, interpretation of simulation results and sanity checking)
- Simulation Techniques for Non-linear and Time-Varying Systems (Complex envelope memoryless systems, AM/AM)
- Advanced Channel Models
- Variance Reduction Techniques

Teaching and Learning Methods

- Lectures
- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

Construction Facility:
Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

Academic Support:
Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

1- Written exams
2- Seminars
3- Assignments
4- Discussions

Schedule:

Assessment 1	7th Week Written Exam
Assessment 2	12th Week Written Exam
Assessment 3	Continuous Assessments
Assessment 4	16th Week Final Written Exam

Weighing of Assessment:

7th Week Examination	20 %
12th Week Examination	20 %
Final-term Examination	40 %
Oral Examination	10 %
Practical Examination	0 %
Semester Work	10 %
Total	100%

References

- Steven M. Rubin, “Computer Aids for VLSI Design”, Second Edition, 1998.
- Revised Printing, ”Digital System Testing and Testable Design”, AT&T 1990.

- Laung-Terng Wang, Cheng-Wen Wu, Xiaoqing Wen, " VLSI Test Principles and Architectures Design for Testability", 2006 by Elsevier Inc.
- R. Jacob Baker, "CMOS Circuit Design, Layout, and Simulation", third edition

  JOHN WILEY & SONS, INC., 2010.

Course Code : **EC 750**

Course Title : **Smart Antenna Technology**

Credit Hours : **3**

Course Description

This course covers these topics: Types of smart antenna systems: switched beam and adaptive array systems and benefits of smart antenna technology; Adaptive beamforming: some of traditional adaptive beamforming approaches such as side lobe cancellers, linearly constrained minimum variance, least mean squares, …, etc.; some of direction of arrival (DOA) algorithms such as multiple signal classification (MUSIC), estimation of signal parameters via rotational invariance technique (ESPRIT), …, etc.; and an electromagnetic (EM) analysis utilized to compute the mutual coupling effects between the finite size antenna elements is described.

Course Objectives

The student should be familiar with the smart antenna systems and what are the benefits of smart antenna technology and be familiar with the fundamental concepts of smart antennas and how the adaptive processing and DOA algorithms are performed using certain criteria. Also, he will be familiar with how the undesired EM effects can be measured and compensated.

Course Topics

- Types of Smart Antenna Systems
- Switched Beam Systems
- Butler Matrix Arrays
- Adaptive Array Systems
- Adaptive Processing Algorithm Classifications
- Maximum Signal to noise ratio criteria
- Minimum mean square error criteria
- Maximum likelihood and minimum variance distortion-less criteria
- Direction of Arrival Estimation
- Direction of Arrival Estimation Technique: MUSIC
- Direction of Arrival Estimation Technique: ESPRIT
- Accounting the mutual coupling among an array of dipoles
- Comparison Between the Switched Beam and Adaptive Array system
- Benefits of Smart Antenna Technology

Intended Learning Outcomes of Course (ILOS)

Knowledge and Understanding

After completing the course students will be able to:

- Explain the knowledge and understanding of smart antennas and its types.
- Summerize the knowledge and understanding of smart antenna and wave propagation.
- Understand the nature of arriving signals and how to process array inputs
- Understand the DOA estimation methods.
- Understand the adaptive methods.
- Understand the undesired EM effects.
- Understand the useful properties of the matrex algebra.

Intellectual Skills

By the end of the course, the student should be able to:

- Adapt and construct smart antenna system.
- Calculate and determine the most basic antenna characteristics (pattern, gain, directivity, radiation efficiency, impedance, current, and polarization).
- Construct computer programs.
- Detect, modify and demonstrate data and apply experiments to obtain new data.
- Determine and modify the undesired EM effect.

Professional Skills

By the end of the course, the student should be able to:

- Perform sufficient mathematical skills to follow, without too much difficulty, the flow of analysis and design of smart antenna system.
- Prepare MATLAB computer programs for analyzing and designing antennas.
- Design a computer program to solve problems.
- Select appropriate tools to measure system performance.
- Design, connect and experiment a system.
- Select appropriate analysis and design tools.

General Skills

After completing the course students will be able to:

- Practice experience and facility in systematic approaches to solve problems.
- Communicate effectively, both orally and in writing.

Course Content

1. Types of Smart Antenna Systems
2. Fundamentals of electromagnetic fields.
3. Wave propagation.
4. Antenna fundamentals.
5. Array antenna fundamentals.
6. Prenciples of random variables and processes.
7. Propagation channle characteristics and improving signal quality.
8. Fundamentals of matrix algebra.
9. Direction of arrival estimation methods.
10. Adaptive beam forming methods.
11. Undesired EM effects compensating methods.
12. Accounting for the mutual coupling among an array of dipoles.

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets

Teaching and Learning Methods for Students with Special Needs

Construction facility:
Room number (234 A) is allocated and equipped with the essential educational tools for handicapped students.

Acdemic support:
Dr.iman Gamal Morsi is appointed as an acdemic advisore.

Student Assessment:

Procedures used:

1- Written exams

2- Assignments

3- Discussions

Schedule:

Assessment 1: 7th Week Written Exam	Week 7th
Assessment 2: 12th Week Written Exam	Week 12th
Assessment 3: Continuous Assessments	Week
Assessment 4: 16th Week Final Exam	Week 16th

Weighing of Assessment:

7th Week Examination	30 %
12th Week Examination	20 %
Final-term Examination	40 %
Oral Examination	0 %
Practical Examination	0 %
Semester Work	10 %
Total	100%

Hill Companies, Inc.

References

- L. C. Godara, *Smart Antennas*, CRC Press LLC, 2004.
- T. K. Sarkar, M. Wicks, M. Salazar-Palma and R. Bonneau, *Smart antennas*, John Wiley and Sons, 2003.
- Frank B. Gross, "Smart Antennas for wireless communications", McGraw-

Course Code : **EC 751**

Course Title : **Computational Electromagnetics using Finite Difference Method**

Credit Hours : **3**

Course Description

The course covers the contemporary and emerging areas in electromagnetic wave technology, the concepts and analysis approaches for numerical stability of FD electromagnetic wave simulations, the theory and numerical implementation of widely used analytical absorbing boundary conditions for FD grids.

Course Objectives

The student should be familiar with the contemporary and emerging areas in electromagnetic wave technology. The student should be able to understand and apply the concepts and analysis approaches for numerical stability of FD electromagnetic wave simulations, the theory and numerical implementation of widely used analytical absorbing boundary conditions for FD grids.

Course Topics

- Introduction to MATLAB
- Introducing several MATLAB codes and how to deal with it
- Review on vector analysis fundamentals of EM theory
- Deriving differential equations of Yee Cell
- Generating Electromagnetic field equations for FDM
- Introducing the concept of absorbing boundary conditions.
- Programming different absorbing boundary conditions.
- Computing the voltage and current from FDM models
- Introducing the concept of the FDFD
- Deriving the equations for the FDFD of the Yee Cell
- Introducing the perfectly matched layer absorbing boundary
- Programming the FDFD MATLAB code
- Introducing the concept of the FDTD
- Deriving the equations for the FDTD of the Yee Cell
- Programming the FDTD MATLAB code
- Final examination

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Students will be able to :
- Examine basic knowledge and concept of different MATLAB functions.
- Know how to program using MATLAB.
- Describe the concept of different EM theories and grasp the knowledge.
- Know how to derive 2nd order differential equations for EM waves.
- Describe the way of generating EM fields for FDM equations by submitting 2 assignments.
- Describe the concept of absorbing boundary conditions by submitting 2 assignments.
- Examine the knowledge and analyze different absorbing boundary techniques using 2 assignments.
- Examine the voltage and current performance of an FDM model.
- Define the concept of FDFD using 1 assignment and 1 written exam.
- Define the way of deriving the FDFD equations of the Yee cell using 1 assignment and 1 written exam.
- Quote with the PML absorbing boundary.
- Describe the FDFD MATLAB code using a written report and a presentation.
- Define the concept of FDTD using 1 assignment and 1 written exam.
- Define the way of deriving the FDTD equations of the Yee cell using 1 assignment and 1 written exam..
- Examine the FDTD MATLAB code using a single assignment and a written exam.

Intellectual Skills

- The student must be able to apply the knowledge of EM theory using 1 assignment.
- Students will be able to demonstrate appropriate knowledge of FDM equations using a student seminar.
- Students will be able to adapt computer programs using MATLAB.
- Students will be able to solve, examine and explain data using a written exam and an essay.

Professional Skills

- Students will be able to explain a simple MATLAB code using 1 report.
- Students will be able to perform an applied model using 1 assignment.
- Students will be able to experiment with special absorbing boundary techniques using 2 assignments.
- The students will be able compare the VI results od different models.
- Students will be able to manipulate appropriate mathematical methods to solve FDTD

problems.

General Skills

- The students will able to practice experience and facility in systematic approaches to solve problems using professional skills.
- The student will be able to comply with the applications of the FDFD using a written project.
- The students will be able to communicate effectively using an oral group project.
- The student must be able to practice using PML using 2 assignments.
- The student must be able to practice solving FDTD problems using 3 assignments.
- The student must be able to comply the learning how to deal with FDTD problems using professional discussions.

Course Content

- Introduction to MATLAB
- Introducing several MATLAB codes and how to deal with it
- Review on vector analysis fundamentals of EM theory
- Deriving differential equations of Yee Cell
- Generating Electromagnetic field equations for FDM
- Introducing the concept of absorbing boundary conditions.
- Programming different absorbing boundary conditions.
- Computing the voltage and current from FDM models
- Introducing the concept of the FDFD
- Deriving the equations for the FDFD of the Yee Cell
- Introducing the perfectly matched layer absorbing boundary
- Programming the FDFD MATLAB code
- Introducing the concept of the FDTD
- Deriving the equations for the FDTD of the Yee Cell
- Programming the FDTD MATLAB code
- Final examination.

Teaching and Learning Methods

- Lectures

- Reports & sheets
- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Academic Support:

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

References

Student Assessment:

Procedures used:

1- quizzes to assess the understanding of theoretical principles
2- assignments to assess students ability to practically imply theoretical principles
3- MATLAB assignments to assess the level understanding of the software
4- A project to assess overall understanding of the course

Schedule:

Assessment 1 (7th and 12th Week Written Exam)

Assessment 2 (7th and 12th Week oral Exam)

Assessment 3 (7th and 12th Week practical Exam)

Assessment 4 (continuous assessment)

Assessment 5 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

- M. H. Al Sharkawy, V. Demir, and A. Elsherbeni, Electrodynamic Scattering Using the Iterative Multiregion Technique, Morgan & Claypool, December 2007.

- Taflove and S. C. Hagness, Computational Electrodynamics (The Finite Difference Time-Domain Method)Artech House 2000..

Course Code : **EC 752**

Course Title : **Advanced Analog & RF Integrated Circuits**

Credit Hours : **3**

Course Description

The course covers the following topics: Review on MOSFET physics- channel length modulation effect- sub threshold operation- short channel effect-scaling theory-constant field and constant voltage scaling-mobility degradation with vertical field-velocity saturation-hot carrier effect-quasi ballistic MOSFET - ballistic MOSFET and carbon nano tube- level 1, level 2 and level 3 models

Course Objectives

The student should be familiar with the impact of reducing the MOSFET dimensions (channel length) on the performance of the device from different aspects as the speed of operation, the power handling capability, the noise immunity, and integration

The student should be able to model the nano transistor and use simulators to analyze, design and synthesize electronic circuits including nano transistors

Course Topics

- CMOS Device Modeling in Circuit Design: Small & Large signal models, device parasitic, SPICE Simulation
- Current and Voltage References, Bandgap Reference
- Current Amplifiers, High-Gain Architectures
- Design of CMOS Operational Amplifiers: Compensation, Two-Stage Op Amps, Power-Supply Rejection Ratio, Cascade Op Amps, Simulation of Op Amps
- High Performance CMOS Op Amps: Buffered , High-Speed/Frequency, Differential-Output Op Amps
- Comparators, Filters, Two-Phase Switched Capacitor Circuits
- Digital-Analog and Analog-Digital Converters: Specifications, S&H, parallel and serial ADC and DACs
- RF transistor small-s model, parasitic, cutoff frequency, RF models of R, L, C components
- RF Amplifiers: Bandwidth estimation and enhancement.
- High-Speed RF amplifiers
- Intercept point, Gain compression and Blocking.
- Noise theory and modeling of noise in resistors and MOSFETs
- RF Low Noise Amplifiers (LNAs)
- RF Mixers
- VCOs and Phase Locked Loops
- Frequency Synthesizers and transceiver architecture.

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Students will be able to :
- Define the basic knowledge, concepts of mathematics and sciences and engineering principles to Advanced Analog and RF Integrated Circuits with accuracy 80 %.
- Define CMOS Device Modeling in Circuit Design.
- Define Current and Voltage References, Band-gap Reference using 1 case report.
- Define Current Amplifiers, High-Gain Architectures using 1 case report.
- Describe CMOS Operational Amplifiers: Compensation, Two-Stage Op Amps. And, Cascode Op mps using 1 case report.
- Describe High Performance CMOS Op Amps: Buffered, High- Speed/Frequency, Differential-Output Op Amps using 1 case report.
- Define Comparators, Filters, and Two-Phase Switched Capacitor Circuits using a group project.
- Identify Digital-Analog and Analog-Digital Converters: Specifications, S&H, parallel and serial ADC and DACs using a student seminar.
- Define RF transistor small- signal model, parasistics, cutoff frequency, RF models of R, L, C components using homework assignments.
- Describe RF Amplifiers: Bandwidth estimation and enhancement using homework assignments and a written exam. High-Speed RF amplifiers, Intercept point, Gain compression and Blocking.
- Identify Noise theory and modeling of noise in resistors and MOSFETs using 1 case report.
- Identify RF Low Noise Amplifiers (LNAs) using a student seminar.
- Identify RF Mixers enhancement using homework assignments and a written exam.
- Identify VCOs and Phase Locked Loops using homework assignments.
- Identify Frequency Synthesizers and transceiver architecture using a group project.

Intellectual Skills

- Demonstrate, calculate data and apply experiments to obtain new data using 2 design assignments.
- Examine the operation of advanced Analog and RF Integrated Circuits using computer programs.
- Demonstrate the learning to simulate various advanced Analog and RF Integrated Circuits performances using simulating programs.

Professional Skills

- Analyze a computer to various advanced Analog and RF Integrated Circuits performance using computer programs.
- Select appropriate tools to measure system performance.
- Experiment a computer programs for studying the performance of various advanced Analog and RF Integrated Circuits using a written report.
- Distinguish relevant laboratory

General Skills

- Comply experience and facility in systematic approaches to solve problems with efficiency 80 %.
- Comply the performance of various Analog and RF Integrated Circuits using a simulation tool.
- Communicate effectively, both orally and in writing using a case written report.
- Course Content
- CMOS Device Modeling in Circuit Design:
- Small & Large signal models, device parasitics, SPICE Simulation
- Current and Voltage References, Bandgap Reference
- Current Amplifiers, High-Gain Architectures
- Design of CMOS Operational Amplifiers:
- Compensation, Two-Stage Op Amps, Power-Supply Rejection Ratio, Cascode Op Amps, S imulation of Op Amps
- High Performance CMOS Op Amps: Buffered , High peed/Frequency, Differential-Output Op Amps
- Comparators, Filters, Two-Phase Switched Capacitor Crcuits
- Digital-Analog and Analog-Digital Converters:
- Specifications, S&H, parallel and serial ADC and DACs
- RF transistor small-s model, parasistics, cutoff
- Frequency, RF models of R, L, C components
- RF Amplifiers: Bandwidth estimation and Ehancement.
- High-Speed RF amplifiers, Intercept point, Gain Compression and Blocking.
- Noise theory and modeling of noise in resistors and MOSFETs
- RF Low Noise Amplifiers (LNAs)

- RF Mixers
- VCOs and Phase Locked Loops
- Frequency Synthesizers and transceiver architecture.
- Final examination

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.
- Door arches should be wide enough to let wheel chairs pass through easily and conveniently.
- Lifts should be provided for movement between floors.
- Doors should be made from light weight materials to make it easy for the handicapped suffering from weakness in limb muscles or those handicapped using prosthetic limbs to deal with them with the least muscular effort.
- Class floors should be made from non-slippery materials to prevent falls on the part of the handicapped.
- Sudden change in the floor level should be prevented even if it is a slight change.

Design Considerations of the Classes

- Class boards should be placed at 60 cm high to allow wheeled chair users or those suffering from limited arm mobility use them.
- Enough spaces should be left between seats and benches to prevent hindering the movement of wheeled chairs between them.
- Handicapped students should sit among normal people in class to be able to interact with them. Nevertheless, in urgent cases according to the nature of the disability, the handicapped students sit in fixed suitable places whether at the front or the back of the class.
- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Academic Support:

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.

Constant follow up should be done for handicapped students after each assessment to evaluate their academic level of achievement

Student Assessment:

Procedures used:

1- Quizzes to assess the understanding of theoretical principles

2- Assignments to assess students' ability to practically imply theoretical principles.

3- Term paper to assess surveys and report writing.

4- A project to assess overall understanding of the course

Schedule:

Assessment 1 (7th and 12th Week Written Exam)
Assessment 2 (7th and 12th Week oral Exam)
Assessment 3 (7th and 12th Week practical Exam)
Assessment 4 (continuous assessment)
Assessment 5 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

References

- CMOS Analog Circuit Design, Phillip E. Allen and Douglas R. Holberg
- The Design of CMOS Radio-Frequency Integrated Circuits, Thomas Lee, Cambridge University Press.

EDA Tools:

- Microwind for layout
- QUCS RF circuit simulator

Course Code : **EC 753**

Course Title : **Nanoelectronics**

Credit Hours : **3**

Course Description

The course covers the following topics: Review on MOSFET physics- channel length modulation effect- sub threshold operation- short channel effect-scaling theory-constant field and constant voltage scaling-mobility degradation with vertical field-velocity saturation-hot carrier effect-quasi ballistic MOSFET - ballistic MOSFET and carbon nano tube- level 1, level 2 and level 3 models

Course Objectives

The student should be familiar with the impact of reducing the MOSFET dimensions (channel length) on the performance of the device from different aspects as the speed of operation, the power handling capability, the noise immunity, and integration

The student should be able to model the nano transistor and use simulators to analyze, design and synthesize electronic circuits including nano transistors

Course Topics

- Review on MOSFET physics
- Channel length modulation effects
- Short channel effects
- Scaling theory- constant field scaling
- Scaling theory- constant voltage scaling
- Mobility degradation with vertical field
- Velocity saturation
- Hot carrier effects
- Quasi ballistic transport- quasi ballistic transistor
- Ballistic transport- ballistic transistor
- Deflection type ballistic transistor
- Single-electron transistor
- Carbon nanotubes
- Applications using nano transistors

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

Students will be able to :

- Define the basic knowledge, concepts of MOSFET physics.
- Define Channel length modulation effects and short channel effects.
- Understand and describe Scaling theory; both constant field scaling and constant voltage scaling.
- Define Mobility degradation with vertical field.
- Define velocity saturation and hot carrier effects
- Define and examine quasi ballistic transport, quasi ballistic transistor and ballistic transistor.
- Examine and define the Single electron transistor.
- Identify Carbon nanotubes.
- Define and identify Applications using nano transistors.
- Describe nano electronic devices using homework assignments and a written exam.

Intellectual Skills

Students will be able to :

- Demonstrate, calculate and explain data and design experiments to obtain new data using 2 design assignments.
- Examine the operation of nano electronic devices using computer programs.
- Demonstrate the learning to simulate various advanced nano electronic devices performances using simulation programs.

Professional Skills

Students will be able to :

- Analyze a computer to simulate various nano electronic devices performance using computer programs.
- Experiment a computer programs for studying the performance of various advanced nano electronic devices using a written report.
- Analyze, compare, and design a nano electronic system using a professional discussion.
- Distinguish relevant laboratory equipment and analyze the results correctly using a written report.

General Skills

The students will able to:

- Comply experience and facility in systematic approaches to solve problems with efficiency 80 %.
- Comply the performance of various nano electronic devices using a simulation tool.
- Communicate effectively, both orally and in writing using a case written report.

Course Content

1- Review on MOSFET physics

2- Channel length modulation effects

3- Short channel effects

4- Scaling theory- constant field scaling

5- Scaling theory- constant voltage scaling

6- Mobility degradation with vertical field

7- Velocity saturation

8- Hot carrier effects

9- Quasi ballistic transport- quasi ballistic transistor

10- Ballistic transport- ballistic transistor

11- Deflection type ballistic transistor

12- Single-electron transistor

13- Carbon nanotubes

14- Applications using nano transistors

15- Student presentations.

16- Final examination.

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

Engineering Requirements and Design Considerations in School Buildings and its Leading Passages

- The design of school parameters and pedestrian passages leading to it should be sloppy to allow for the transportation of the handicapped; whether the handicapped are using wheeled chairs, crutches or prosthetic limbs.

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- Handicapped students should sit close to the main exits of the class to be able to evacuate in case of emergencies like fires.

Academic Support:

Dr. Iman Gamal Morsi is appointed as an academic supervisor for handicapped students.
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Student Assessment:

Procedures used:

1- Quizzes to assess the understanding of theoretical principles

2- Assignments to assess students' ability to practically imply theoretical principles.

3- Term paper to assess surveys and report writing.

4- A project to assess overall understanding of the course

Schedule:

Assessment 1 (7th and 12th Week Written Exam)
Assessment 2 (7th and 12th Week oral Exam)
Assessment 3 (7th and 12th Week practical Exam)
Assessment 4 (continuous assessment)
Assessment 5 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

References

- Nanoelectronics Principles and Devices, Dragoman & Dragoman, Artech House, 2006.
- Nanotechnology and Nanoelectronics, Fokrner, Ed. Springer, 2005
- Nanoelectronics and Information Technology, Waser, Ed., 2nd Ed, Wiley-VCH 2005.
- Design of Analog CMOS Integrated Circuits, Razavi, MvGraw-Hill, 2001.

Course Code : **EE 749**
Course Title : **Renewable Energy Systems**

Credit Hours : **3**

Course Description

Course Objectives

- Graduate student should be acquainted with various types of renewable energy systems.
- Graduate student should be acquainted with decision making based on energy systems economics and environmental aspects.

Course Topics

- Introduction to renewable energy sources.
- Characteristics of solar radiation and solar thermal energy.
- Solar photovoltaic.
- Wind energy.
- Tide and ocean wave generation systems.
- Present and future status of wind systems.
- Energy storage elements
- Economics of energy systems.
- Environmental aspects of energy systems.

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- The course explores the technical, economic, environmental and policy aspects of renewable and alternative energy systems to provide a comprehensive picture of their role in meeting society's electricity needs.
- Identifying the role of new energy resource technologies with the application of power electronics, the use of demand-side management, and the effects of market forces in addressing these challenges
- In addition, the economic and regulatory policy aspects of electricity and electricity markets are described.

Intellectual Skills

- Discovering engineering aspects of alternative source generation technologies (thermodynamics considerations; solar resource and solar array systems; wind resource and wind generation systems; other renewable resource technologies; hydro, geothermal, closed system fuel cells)
- Examining principles of electrical storage technologies: electrical vs. chemical energy storage; batteries; double-layer capacitors; superconducting magnetic energy storage; flywheels)

Professional Skills

- Students should be able to use computer programs for solving different renewable energy network problems.

General Skills

- Communication with other graduate students to comment and share knowledge related to their work.

Course Content

- Introduction to renewable energy sources.
- Characteristics of solar radiation and solar thermal energy.
- Solar photovoltaic.
- Wind energy.
- Tide and ocean wave generation systems.
- Present and future status of wind systems.
- Energy storage elements
- Economics of energy systems.
- Environmental aspects of energy systems.

Teaching and Learning Methods

- Lectures

Teaching and Learning Methods for Students with Special Needs

- Lectures
- Assignments

Student Assessment

Procedures used:

- Written Examinations to asses The Intended Learning Outcomes
- Class Activities (Reports, Discussions, ------) to asses the Intellectual Skills

Schedule:

Assessment 1 (7th and 12th Week Written Exam)

Assessment 2 (7th and 12th Week oral Exam)

Assessment 3 (7th and 12th Week practical Exam)

Assessment 4 (continuous assessment)

Assessment 5 (16th week Final Exam)

Weighing of Assessment:

Assessment 1	40%
Assessment 2	5%
Assessment 3	10%
Assessment 4	5%
Assessment 5	40%
Total	100%

References

- Bent Sorensen "Renewable Energy", ELSEVIER Academic press, 2004.
- Godfrey Boyle "Renewable Energy", Open University, Oxford, 2004.
- John Twidell, "Renewable Energy Resources", Spon press, London, 2004.

Course Code : **CC 714**
Course Title : **Computer Security**

Credit Hours : **3**

Course Description

Course Objectives

This course aims to introduce the main concepts of computer and network security. The course introduces security goals and services. It also defines security threats and system's vulnerabilities. Classical and modern encryption techniques are explained. The course includes sufficient information about network security such as Authentication, IP security, and web security. Finally, the course looks at system-level security such as threats of viruses and the use of firewalls.

Course Topics

- Learn Security Protocols.
- Learn the importance of Network security and Security systems.
- Achieve the goals and the services of security system.
- Distinguish between the available methods of defense.
- Distinguish between Cryptography and Steganography.
- Differentiate between various classical encryption techniques (Caesar, Mono-alphabetic, and poly-alphabetic ciphers)
- Understand the Data Encryption Standard algorithm with great details.
- Compare between different symmetric key encryption algorithms.
- Understand the concept of Public-key encryption models and detailed RSA algorithm
- Learn different mechanisms of authentication service, IP security, and web security protocols.
- Distinguish between various malicious programs such as viruses, worms, logic bombs and Trojan horses.
- Understand the concept of firewalls.

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- The course explores the technical, economic, environmental and policy aspects of renewable and alternative energy systems to provide a comprehensive picture of their role in meeting society's electricity needs.
- Identifying the role of new energy resource technologies with the application of power electronics, the use of demand-side management, and the effects of market forces in addressing these challenges
- In addition, the economic and regulatory policy aspects of electricity and electricity markets are described.

Intellectual Skills

- Understand the importance of security systems
- Understand types of security threats, system vulnerabilities and security goals and services.
- Understand the basic concepts and techniques of data security.
- Understand the DES and RSA algorithms.
- Have some understanding of the basic key distribution techniques.
- Have some understanding of the basic authentication and web security methods.

Professional Skills

- Implement some of classical ciphering techniques.
- Implement S-DES algorithm.
- Implement RSA algorithm.
- Professionally present security package.

General Skills

- Work effectively within a group.
- Work effectively within assignments
- Work to tight deadlines.
- Effectively present the final work in a demo.

Course Content

- Introduction, History, and Ethics
- Security vulnerabilities and attacks Analysis
- Model for network security, and methods of defense
- Cryptographic Algorithms
- Advanced Encryption Standard (AES)
- Contemporary Symmetric Ciphers
- Confidentiality using Symmetric Cryptography
- Cryptanalysis Tools and Techniques
- Public-key Cryptosystems and RSA
- Message Authentication and Digital Signature Algorithms
- Network Security Practice
- Network Protection and Intrusion Detection
- Web Application Vulnerability Analysis

- Projects Discussion and Recommendations

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Practical work
- Seminars

Teaching and Learning Methods for Students with Special Needs

- Lectures
- Tutorials
- Reports & sheets
- Practical work
- Seminars

Student Assessment

Written Examinations to asses The Intended Learning Outcomes

Class Activities (Reports, Discussions, ------) to asses The Intellectual Skills

Procedures used:

Written Examinations to asses The Intended Learning Outcomes

Class Activities (Reports, Discussions, ------) to asses The Intellectual Skills

Schedule:

Assessment 1	Midterm Exam
Assessment 2	Final Exam
Assessment 3	Writing Technical Report
Assessment 4	Seminar and discussion
Assessment 4	Semester Work

Weighing of Assessment:

Midterm Exam	20 %
Final Exam	30 %
Writing Technical Report	20 %
Seminar and discussion	15 %
Semester Work	15 %
Total	100%

References

- Cryptography and Network Security Principles and Practices, 4 th Ed., William Stallings, Printice Hall, 2009.

- Applied Cryptography, Second Edition, Bruce Schneier, John Wiley & Sons, 1996John Twidell, “Renewable Energy Resources", Spon press, London, 2004.

Course Code : **CC 733**
Course Title : **Analysis and Design of Computer Networks**

Credit Hours : **3**

Course Description

Course Objectives

- Emphasize topics of fundamental importance concerning the technology and architecture of LANs.
- Highlight various LAN protocols & standards.
- Discuss LANs internet working & interoperability.
- Expose students to actual LAN realizations, using the available networking facilities.

Course Topics

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Understand various topics of fundamental concerning the technology and architecture of LANs.
- Understand various topics of fundamental concerning the technology and architecture of LANs.
- Realize the important concepts in LANs internetworking & interoperability
- How to measure LAN performance.

Intellectual Skills

- Understand LAN internetworking: bridges, routers & gate ways
- Realize LAN: servers, standards, operating systems, management and performance
- Understand high speed LAN technologies and standard.

Professional Skills

- Testing LAN performance
- LAN Simulation.

General Skills

- Understand LAN: access methods: CSMA, TOKEN Passing
- Understand the fundamental importance concerning the technology and architecture of LANs

Course Content

- History and overview
- LAN media types and topologies
- LAN signaling & access
- Layered Architectures and standard
- Ethernet and IEEE 802.3
- Ethernet and IEEE 802.3
- 7th week exam
- Token ring and IEEE 802.5
- Token ring and IEEE 802.5
- LAN internetworking
- LAN interoperability
- LAN management
- 12th week exam
- LAN performance
- Compiler design stages
- Final exam

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Student Assessment

Written Examinations to asses The Intended Learning Outcomes

Class Activities (Reports, Discussions, ------) to asses The Intellectual Skills

Procedures used:

Written Examinations to asses The Intended Learning Outcomes

Class Activities (Reports, Discussions, ------) to asses The Intellectual Skills

Schedule:

Assessment 1	7th Week Written Exam
Assessment 2	12th Week Written Exam
Assessment 3	Continuous Assessments
Assessment 4	16th Week Final Written Exam

Weighing of Assessment:

12th Week Examination	20 %
Final-term Examination	40 %
Oral Examination	0 %
Practical Examination	0 %
Semester Work	10 %
Total	100%

References

- local area networks, Peter Hodson DP, 1994

Course Code : **CC 752**
Course Title : **System Science & Engineering**

Credit Hours : **3**

Course Description

Course Objectives

- The course educates students in the engineering and science of systems. Graduates are expected to have mathematical competence and knowledge of systems analysis, and design methods, probability analysis, dynamic systems, system reliability, estimation, modeling, identification, and simulation.
- Elaborate developments of nonlinear signal and information processing methods from a generic systems engineering perspective.
- The use of Wavelets to analyze data that changes over time or has hidden "events" that would not show up on an FFT. Understand and efficiently use the types of Wavelet Transforms to better analyze and process data. State-of-the-art methods and applications. The course will handle the compression and de-noising of data using advanced Wavelet techniques and how to avoid potential pitfalls by understanding the concepts. How to increase productivity and reduce cost by choosing (or building) a Wavelet that best matches your particular application.

Intended Learning Outcomes of Course (ILOS):

Knowledge and Understanding

- Define the Systems engineering interdisciplinary field.
- Describe reliability models and parameters.
- Understanding the systems engineering process and models for graphic representations
- Analyses problems, probabilities and performance measures.
- Understanding and analyses of different design models.
- Provides the underpinning signal processing, system identification, dynamical analysis and control to support emerging multi-disciplinary design themes.
- Understand Signal spaces and operators, analyses z-transform, and Hilbert transform.
- Understanding the concept of Fourier analysis, the concept of windowing, and discrete-time filter design.
- Define the wavelet transform.
- Describe Multi-rate signal processing systems.
- Define The concepts behind joint time-frequency representations and multiresolution analysis of signals.
- Define the Discrete-Time Bases and Filter Banks
- Understanding the Wavelet families, Wavelet series and its properties.

- Define the multi-dimensional filter banks and Compressed sensing.
- Define signal denoising and feature extraction.

Intellectual Skills

- Classify the design process.
- Calculate the performance measures.
- Classify signal spaces and operators, analyses.
- Classification of compression techniques and data denoising.

Professional Skills

- Understanding the reliability models and parameters
- Understanding the systems engineering process and models for graphic representations.
- Analyze and simulate different design models.
- Analyze the signal spaces and operators in time domain and frequency domain.
- Implementing different decomposition filter banks and study the characteristics.
- Explain and simulate the basic operation of signal denoising.

General Skills

- Verify theory with practice
- Verify with practice Exercise on different models.

Course Content

- Introduction to Systems engineering, Systems engineering principles.
- Reliability engineering, failure modes and effects analysis,
- The systems engineering process, Using models, Tools for graphic representations.
- Performance engineering
- System stability, estimation, system analysis, modeling, dynamic systems, probability analysis, and simulation.
- Signal Processing and Complex Systems, information processing methods from a generic systems engineering perspective
- Digital and analogue signal analysis, z-transform, and
- Hilbert transform.
- Fourier Analysis, Limitations and relations to other Fourier techniques. The concept of windowing and its implications in the different application contexts of spectrum estimation and discrete-time filter design.
- Introduction to Wavelet transform. he continuous and discrete wavelet transforms and their roles in signal

- Processing applications.
- Discrete-Time Bases and Filter Banks
- Analysis and design of filter banks, Orthogonal and biorthogonal filter banks, Tree-structured filter banks, Discrete wavelet transform.
- Wavelet families.
- Wavelet series and its properties.
- Regularity and approximation properties
- Multidimensional filter banks, Multiscale geometric representation and processing.
- 2D and 3D signal analyses.
- Signal denoising, Feature extraction, and Inverse problems

Teaching and Learning Methods

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Teaching and Learning Methods for Students with Special Needs

- Lectures
- Tutorials
- Reports & sheets
- Laboratories
- Seminars

Student Assessment

Written Examinations to asses The Intended Learning Outcomes

Class Activities (Reports, Discussions, ------) to asses The Intellectual Skills

Procedures used:

Written Examinations to asses The Intended Learning Outcomes

Class Activities (Reports, Discussions, ------) to asses The Intellectual Skills

Schedule:

Assessment 1	7th Week Written Exam
Assessment 2	12th Week Written Exam
Assessment 3	Continuous Assessments
Assessment 4	16th Week Final Written Exam

Weighing of Assessment:

12th Week Examination	20 %
Final-term Examination	40 %
Oral Examination	0 %
Practical Examination	0 %
Semester Work	10 %
Total	100%

References

- M. Vetterli, J. Kovacevic, and V. K. Goyal, "The World of Fourier and Wavelets: Theory, Algorithms and Applications," (manuscript); available for purchase from the IEEE store in Everitt Lab; downloadable from http://www.fourierandwavelets.org.
- M. Vetterli and J. Kovacevic, "Wavelets and Subband Coding," Prentice Hall, 1995; downloadable from http://www.waveletsandsubbandcoding.org

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(in alphabetical order)

- **Abd Elmonieum A. Nasser**
  Ph.D., Kent University, UK, 1992.
  Electronics and Communications**.**

- **Amr M. El-Helw**
  Ph.D., Staffordshire University, UK, 2008.
  Pattern Recognition, Spread Spectrum.

- **Darwish A. Mohamed**
  Ph.D., Military Technical College, Egypt, 1988.
  Electromagnetics and Antennas.

- **Ehab F. Badran**
  Ph.D., Louisiana State University (LSU), USA, 2002.
  Signal Processing and Wireless Communications.

- **El-Sayed A. Yousef**
  Ph.D., University of Alberta, Canada, 1972.
  Communications Engineering.

- **Farouk A. Salem**
  Ph.D., Rostock University, Germany, 1997.
  Communications Engineering.

- **Heba A. Fayed**
  Ph.D., Alexandria University, Egypt, 2011.
  Communications Engineering.

- **Heba Shaban**
  Ph.D., Virginia Tech, USA, 2010.
  Communications Engineering.

- **Ibrahim A. El Rube**
  Ph.D., Waterloo University, Canada, 2006.
  Pattern Analysis andRecognition.

- **Iman G. Morsi**
  Ph.D., Alexandria University, Egypt, 2002.
  Measurements and Instrumentation.

- **Maha A. Sharkas**
  Ph.D., Alexandria University, Egypt, 2002.
  Digital Signal Processing.

- **Mohab A. Mangoud**
  Ph.D., University of Bradford, UK, 2001.
  Communications Engineering.

- **Mohamed El-Sharkawy**
  Ph.D., University of Mississippi, USA, 2006.
  Electromagnetics and Antennas.

- **Mohamed E. Khedr**
  Ph.D., University of Ottawa, Canada, 2004
  Wireless Communications.

- **Mohamed Y. Omar**
  Ph.D., Alexandria University, Egypt, 2007.
  Communications Engineering.

- **Moustafa H. Aly**
  Ph.D., Alexandria University, Egypt, 1987.
  Optical Fibers.

- **Noha O. El-Ganainy**
  Ph.D., Alexandria University, Egypt, 2006.
  Electronics Engineering.

- **Roshdy A. AbdelRassoul**
  Ph.D., Southern Methodist University (SMU), USA, 1981.
  Electronic Devices and Circuits.

- **Said I. El-Khamy**
  Ph.D., University of Massachussetts, USA, 1972.
  Communications Engineering.

- **Sharaf E. El Nahass**
  Ph.D., Washington University, USA, 1984.
  Electronic Communications.