GRADUATE STUDIES:

(Addendum)

Master of Engineering Programs

(M.Eng.)

2009
ELECTRONICS AND COMMUNICATIONS ENGINEERING

M.Eng. Program
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 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.Eng. 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.Eng. 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.Eng. 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.
### M.Eng. in Electronics and Communications Engineering

**Program Structure**

**Division (A): Electronics Engineering**

**Division (B): Communications Engineering**

### M.Eng. in Electronics and Communications Engineering

**DIVISION (A): ELECTRONICS ENGINEERING**

#### CORE COURSES:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 721</td>
<td>Advanced Digital Communications</td>
<td>3</td>
</tr>
<tr>
<td>EC 731</td>
<td>Advanced Digital Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>EC 732</td>
<td>Automated Measurements</td>
<td>3</td>
</tr>
</tbody>
</table>

Subtotal: 3 Courses * 3 Credit Hours = 9

### DIVISION (B): COMMUNICATIONS ENGINEERING

#### CORE COURSES:

<table>
<thead>
<tr>
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<tbody>
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<td>Advanced Digital Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>EC 742</td>
<td>Microwave Antennas Systems</td>
<td>3</td>
</tr>
</tbody>
</table>

Subtotal: 3 Courses * 3 Credit Hours = 9

### Divisions (A) and (B)

#### ELECTIVE COURSES:

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

continued/…
## M.Eng. in Electronics and Communications Engineering

### Program Structure

**Division (A): Electronics Engineering**  
**Division (B): Communications Engineering**

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<table>
<thead>
<tr>
<th>Course Code</th>
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</thead>
<tbody>
<tr>
<td>EC 730</td>
<td>Audio and Video Compression</td>
<td>3</td>
</tr>
<tr>
<td>EC 733</td>
<td>Photonic Devices</td>
<td>3</td>
</tr>
<tr>
<td>EC 734</td>
<td>Non-Silicon Semiconductors</td>
<td>3</td>
</tr>
<tr>
<td>EC 735</td>
<td>Electronics Seminar</td>
<td>3</td>
</tr>
<tr>
<td>EC 736</td>
<td>Neural Networks Applications</td>
<td>3</td>
</tr>
<tr>
<td>EC 737</td>
<td>Advanced Digital VLSI Design and Testing</td>
<td>3</td>
</tr>
<tr>
<td>EC 738</td>
<td>Advanced Electronic Devices</td>
<td>3</td>
</tr>
<tr>
<td>EC 739</td>
<td>Analog VLSI Design</td>
<td>3</td>
</tr>
<tr>
<td>EC 742</td>
<td>Microwave Antennas Systems</td>
<td>3</td>
</tr>
<tr>
<td>EC 743</td>
<td>Antennas for Mobile Communications</td>
<td>3</td>
</tr>
<tr>
<td>EC 744</td>
<td>Wireless Communications</td>
<td>3</td>
</tr>
<tr>
<td>EC 745</td>
<td>Telecommunication Networks</td>
<td>3</td>
</tr>
<tr>
<td>EC 746</td>
<td>Mobile Data Management</td>
<td>3</td>
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<tr>
<td>EC 747</td>
<td>Advanced Digital Image Processing</td>
<td>3</td>
</tr>
<tr>
<td>EC 748</td>
<td>Multimedia Communications Systems</td>
<td>3</td>
</tr>
<tr>
<td>EC 749</td>
<td>Computer-Aided Design and Analysis of Communication Systems</td>
<td>3</td>
</tr>
<tr>
<td>EC 750</td>
<td>Smart Antenna Technology</td>
<td>3</td>
</tr>
<tr>
<td>EC 751</td>
<td>Computational Electromagnetics using Finite Difference Method</td>
<td>3</td>
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</table>

**Elective Subtotal**: 7 Courses * 3 Credit Hours = 21 Credit Hours

### Applied Research:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EC 799</td>
<td>Applied Research</td>
<td>6</td>
</tr>
</tbody>
</table>

**Subtotal**: 6 Credit Hours = 6 Credit Hours

**Total**: 36 Credit Hours
### M.Eng. in Electronics and Communications Engineering
#### Division (C): Biomedical Engineering

**Core Courses:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE 711</td>
<td>Introduction to Biomedical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BE 712</td>
<td>Elementary Human Anatomy</td>
<td>3</td>
</tr>
<tr>
<td>BE 713</td>
<td>Elementary Human Physiology</td>
<td>3</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>3 Courses * 3 Credit Hours</strong></td>
<td><strong>9</strong></td>
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**Elective Courses:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>BE 715</td>
<td>Biological Systems Modeling and Analysis</td>
<td>3</td>
</tr>
<tr>
<td>BE 716</td>
<td>Biomedical Measurements</td>
<td>3</td>
</tr>
<tr>
<td>BE 717</td>
<td>Medical Imaging</td>
<td>3</td>
</tr>
<tr>
<td>BE 718</td>
<td>Biomedical Signal Processing</td>
<td>3</td>
</tr>
<tr>
<td>BE 719</td>
<td>Statistics for Biomedical Engineering</td>
<td>3</td>
</tr>
<tr>
<td>BE 720</td>
<td>Magnetic Resonance Imaging</td>
<td>3</td>
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<tr>
<td>BE 721</td>
<td>Biosensors</td>
<td>3</td>
</tr>
<tr>
<td>BE 722</td>
<td>Biomedical Seminar</td>
<td>3</td>
</tr>
<tr>
<td>BE 723</td>
<td>Neural Networks</td>
<td>3</td>
</tr>
<tr>
<td>BE 724</td>
<td>Advanced Patient Monitoring and Safety</td>
<td>3</td>
</tr>
<tr>
<td>BE 725</td>
<td>Telemedicine Networks</td>
<td>3</td>
</tr>
<tr>
<td>BE 726</td>
<td>Special Topics in Biomedical Engineering</td>
<td>3</td>
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<tr>
<td><strong>Subtotal</strong></td>
<td><strong>7 Courses * 3 Credit Hours</strong></td>
<td><strong>21</strong></td>
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**Applied Research:**

<table>
<thead>
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<th>Course Title</th>
<th>Credit Hours</th>
</tr>
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<tbody>
<tr>
<td>BE 799</td>
<td>Applied Research</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>36</strong></td>
</tr>
</tbody>
</table>
Courses

Detailed Structure
Course Detailed Structure

Electronics and Communications Engineering

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

References
Course Detailed Structure

Electronics and Communications Engineering

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
- Bayes’s decision: Theory and traditional classifiers
- Neural Network classifiers
- Speech/speaker recognition and hidden Markov Models
- Image recognition

References
- Duda and Hart, *Pattern Classification and Scene Analysis*, Wiley, 1973
Course Detailed Structure

Electronics and Communications Engineering

Course Code : EC 721
Course Title : Advanced Digital Communications
Credit Hours : 3

Course Description

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

References
Course Detailed Structure

Electronics and Communications Engineering

Course Code : EC 722
Course Title : Optical Communications
Credit Hours : 3

Course Description

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

References
Course Detailed Structure

Electronics and Communications Engineering

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

References
Course Detailed Structure

Electronics and Communications Engineering

Course Code : EC 724
Course Title : Mobile and Spread Spectrum Communications
Credit Hours : 3

Course Description

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

References
Course Detailed Structure

Electronics and Communications Engineering

Course Code : EC 725
Course Title : Speech Signal Processing and Digital Telephony
Credit Hours : 3

Course Description

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

References
Course Detailed Structure

Electronics and Communications Engineering

Course Code : EC 726
Course Title : Adaptive Signal Processing
Credit Hours : 3

Course Description

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

Course Topics
- Review
- 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

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 Detailed Structure

Electronics and Communications Engineering

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

References
Course Detailed Structure

Electronics and Communications Engineering

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)

References
- According to the subject of the seminar.
Course Detailed Structure

Electronics and Communications Engineering

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

References
- H. Mathews, Surface Wave Filters.
- Surface acoustic wave devices for mobile and wireless communications.
Course Detailed Structure

Electronics and Communications Engineering

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

References
Course Code: EC 731
Course Title: Advanced Digital Signal Processing
Credit Hours: 3

Course Description

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

References
- Steven W. Smith, *The Scientist and Engineer's Guide to Digital Signal Processing*
Course Detailed Structure

Electronics and Communications Engineering

Course Code : EC 732
Course Title : Automated Measurements
Credit Hours : 3

Course Description

Course Objectives
The student should become versed in:

- the theory of operation of different transducers.
- the theory of operation of instrumentation amplifiers
- the data acquisition system concept and theory of operation of its components
- the design of automated measurement systems

Course Topics
- Transducers and Sensors
- Signal conditioning and Data accession and logging
- Computer Interfacing
- Data Communications and Computer Networking for Telemetry

References
- Steven Grengo, Interfacing: A Lab Approach, Prentice Hall.
- Omega Instrumentation, Reference Year Book, V. 127.
Course Detailed Structure

Electronics and Communications Engineering

Course Code : EC 733
Course Title : Photonic Devices
Credit Hours : 3

Course Description

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

References
Course Detailed Structure

Electronics and Communications Engineering

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

References
- Selected papers
Electronics and Communications Engineering

Course Detailed Structure

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

References
- Seetzer, Prezk, Hamdy, *Electronic Analog to Digital Converters*, Wiley
- Selected papers
Course Detailed Structure

Electronics and Communications Engineering

Course Code : EC 736
Course Title : Neural Networks Applications
Credit Hours : 3

Course Description

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

References
**Course Detailed Structure**

**Electronics and Communications Engineering**

**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**

The student should gain knowledge and develop skills in:

- Choice of circuit technology, process circuits associated with various types of components, testing techniques and design for testability

**Course Topics**

- MOS Theory
- Stick Diagrams
- CAD Tools, Introduction to CAD, SPICE Modeling
- Speed and Power considerations
- Resistance estimation
- MOS capacitor and switching characteristics
- Floor planning, layout techniques and design rules
- Design techniques for testability
- Fault Diagnosis and Simulation, Testing Equipment
- Test Program and Test Pattern, Test Flowchart, Plan and Strategy

**References**

Course Detailed Structure

Electronics and Communications Engineering

Course Code : EC 738
Course Title : Advanced Electronic Devices
Credit Hours : 3

Course Description

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

References
Course Detailed Structure

Electronics and Communications Engineering

Course Code :  EC 739
Course Title :  Analog VLSI Design
Credit Hours :  3

Course Description

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

References
- 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 Detailed Structure

Electronics and Communications Engineering

Course Code : EC 742
Course Title : Microwave Antennas Systems
Credit Hours : 3

Course Description

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

References
Course Detailed Structure

Electronics and Communications Engineering

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

References
Course Detailed Structure

Electronics and Communications Engineering

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)
- New WLAN technologies: IEEE 802.11 a, b, and g standards, HIPERLAN, WIMAX
- UWB, Fixed wireless and Local Multipoint Distribution Services (LMDS), DECT systems

References
Course Detailed Structure

Electronics and Communications Engineering

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

References
- According to material contents and simulation tools
Course Detailed Structure

Electronics and Communications Engineering

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 as well as 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

References
- According to material contents and simulation tools
Course Detailed Structure

Electronics and Communications Engineering

Course Code : EC 747
Course Title : Advanced Digital Image Processing
Credit Hours : 3

Course Description

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

References
Course Detailed Structure

Electronics and Communications Engineering

Course Code : EC 748
Course Title : Multimedia Communications Systems
Credit Hours : 3

Course Description

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

References
Course Code : EC 749  
Course Title : Computer-Aided Design and Analysis 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 student will be familiar with the fundamental techniques and algorithms used to model and analyze communication systems using simulations.  

Course Topics  
- Introduction to simulation concept in communication systems  
- Different algorithms used to model digital communications  
- Defining main parameters that to be measured and methods of representation  
- Applying simulation to different communication systems and test validation and accuracy  
- Techniques for modeling time-varying channels  

References  
- According to material contents and simulation tools
Course Detailed Structure

Course Code : EC 750
Course Title : Smart Antenna Technology
Credit Hours : 3

Course Description
Types of smart antenna systems: switched beam and adaptive array systems. Benefits of smart antenna technology. Adaptive beamforming: some traditional adaptive beamforming approaches such as side lobe cancellers, linearly constrained minimum variance, least mean squares. Direction of arrival (DOA) algorithms such as multiple signal classification (MUSIC), estimation of signal parameters via rotational invariance technique (ESPRIT). Electromagnetic (EM) analysis utilized to compute the mutual coupling effects between the finite size antenna elements.

Course Objectives
The student will be familiar with:
- the fundamental concepts of smart antennas,
- methods of performing the adaptive processing and DOA algorithms using certain criteria, and
- methods of measuring and compensating undesired EM effects..

Course Topics
- Types of smart antenna systems
- Adaptive beamforming
- Direction of Arrival (DOA) algorithms
- Accounting for the mutual coupling among an array of dipoles

References
Course Detailed Structure

Electronics and Communications Engineering

Course Code : EC 751
Course Title : Computational Electromagnetics using Finite Difference Method
Credit Hours : 3

Course Description
Tremendous developments in computational power and facilities have made numerical solution of complex practical problems in electromagnetic field possible. Numerical methods such as the Finite Difference Method (FDM), Finite Element Method (FEM), Boundary Element Method (BEM), Method of Moment (MoM), Finite Difference Time Domain (FDTD) are now popular amongst researchers and practicing engineers. The course focuses on the FDM for numerical analysis of electromagnetics problems. Emphasis is placed on the formulation of physical problems into mathematical boundary value problems, numerical discretization of continuous problems into discrete problems, and development of rudimentary computer codes for simulation of electromagnetic fields in engineering problems.

Course Objectives
The student will be familiar with the contemporary and emerging application 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 Topics
- Introduction to MATLAB and how to deal with it
- Review of vector analysis fundamentals of electromagnetic theory:
  - Maxwell's equations
  - Boundary conditions
  - Vector and scalar potentials
  - Radiation condition
  - Radar cross section
- Finite Difference Method
  - Finite difference frequency domain
  - FDTD
  - Absorbing boundary conditions
  - Perfectly matched layers
- Project presentations

References
Course Detailed Structure

Electronics and Communications Engineering

Course Code : BE 711
Course Title : Introduction to Biomedical Engineering
Credit Hours : 3

Course Description

Course Objectives
Students should be able to apply their knowledge in electronics, computers and communications in the analysis and design of patient–care biomedical systems.

Course Topics
- Overview of Biomedical Systems
- Medical Transducers
- Biopotential Amplifiers
- Electrocardiographs
- Pacemakers
- Electroencephalographs
- Individual Student Projects in Biomedical Engineering

Prerequisites
None

References
Course Detailed Structure

Electronics and Communications Engineering

Course Code :  BE 712
Course Title :  Elementary Human Anatomy
Credit Hours :  3

Course Description
An Introduction to Basic Anatomy of the Human Body for Engineers. The Role of Physical Principles and Phenomena as they are known to exist and apply to living systems will be highlighted in engineering terms.

Course Objectives
Students should be acquainted with various levels of structural organization of the human body.

Course Topics
- An introduction to basic anatomy of the human body for engineers
- The role of physical principles and phenomena as they are known to exist and apply to living systems will be highlighted in engineering terms

Prerequisites
None

References
Course Detailed Structure

Electronics and Communications Engineering

Course Code : BE 713
Course Title : Elementary Human Physiology
Credit Hours : 3

Course Description
An Introduction to Basic Physiology of the Human Body for Engineers. The Role of physical principles and phenomena as they are known to exist and apply to living systems will be highlighted in engineering terms.

Course Objectives
Students should be acquainted with various levels of structural organization of the human body.

Course Topics
- An introduction to basic physiology of the human body for engineers
- The role of physical principles and phenomena as they are known to exist and apply to living systems will be highlighted in engineering terms

Prerequisites
None

References
Course Code : BE 715
Course Title : Biological Systems Modeling and Analysis
Credit Hours : 3

Course Description

Course Objectives
Students should be acquainted with quantitative methods in key areas that emphasize the similarities between biomedical and conventional engineering science.

Course Topics
- Electrical Properties of Excitable Tissue
- Bio-fluid Mechanics of Cardiovascular Systems
- Control of Human Posture and Locomotion

Prerequisites
BE 711: Introduction to Biomedical Engineering

References
Course Detailed Structure

Electronics and Communications Engineering

Course Code : BE 716
Course Title : Biomedical Measurements
Credit Hours : 3

Course Description

Course Objectives
Students should be introduced to principles of biophysical measurement and instrumentation.

Course Topics
- Biomedical Instrumentation
- Electrodes
- Biochemical Sensors
- Lasers
- Measurement of Blood Pressure
- Cardiac Output and Respiratory Parameters
- Biostimulation in pacemakers
- Defibrillators and functional Neuromuscular Systems

Prerequisites
BE 711: Introduction to Biomedical Engineering

References
- J.G. Webster, “Medical Instrumentation, Application and Design,” Houghton Mifflin, 1992
Course Detailed Structure

Electronics and Communications Engineering

Course Code : BE 717
Course Title : Medical Imaging
Credit Hours : 3

Course Description

Course Objectives
Students should be acquainted with Imaging Philosophies and current trends in medical imaging systems.

Course Topics
- Human Visual System
- Image formation
- Continuous and Discrete Images Sampling and Quantization
- Image Coding and Enhancement Methods
- Image Quality
- Conventional and Digital X-ray Imaging Systems
- Ultrasound
- Computed Tomography
- Positron Emission Tomography
- Magnetic Resonance Imaging

Prerequisites
BE 711: Introduction to Biomedical Engineering

References
Course Detailed Structure

Electronics and Communications Engineering

Course Code : BE 718
Course Title : Biomedical Signal Processing
Credit Hours : 3

Course Description
Origin and Dynamic Characteristics of Biomedical Signals, Signal Acquisition and Processing, Data Compression, Wavelet Analysis, Advanced Statistics. Neural Networks and Fractals.

Course Objectives
Students should be acquainted with advanced digital signal processing methods in biomedical engineering.

Course Topics
- Origin and Dynamic characteristics of biomedical signals
- Signal acquisition and processing
- Data compression
- Wavelet analysis
- Advanced statistics
- Neural networks and fractals

Prerequisites
BE 711: Introduction to Biomedical Engineering

References
Course Code :  BE 719
Course Title :  Statistics for Biomedical Engineering
Credit Hours :  3

Course Description
Two–Sample Comparisons, Analysis of Variance and Multiple Comparison Procedures, Linear Regression Model, Time Series Models, Tools for Multivariate Data.

Course Objectives
Students should be introduced to advanced statistical methods with applications to biomedical engineering.

Course Topics
- Two–sample Comparisons
- Analysis of Variance and Multiple Comparison Procedures
- Linear Regression Model
- Time Series Models
- Tools for Multivariate Data

Prerequisites
BE 718: Biomedical Signal Processing

References
Course Code : BE 720
Course Title : Magnetic Resonance Imaging
Credit Hours : 3

Course Description

Course Objectives
Students should be introduced to technical principles and medical applications of MRI systems.

Course Topics
- Nuclear Magnetic Resonance with Applications to Medical Imaging Image Processing
- Image Contrast
- Image Artifacts
- Recent Trends in Magnetic Resonance Imaging (MRI)

Prerequisites
BE 717: Medical Imaging

References
Course Code : BE 721
Course Title : Biosensors
Credit Hours : 3

Course Description
Electrochemical Biopotentials, Membrane Electrodes, Double Layer Structures Mass
Transport and Ion Migration, Hydrodynamic Electrodes, Cyclic Voltametryarid,
Neuroscience Applications, Low-Current Measurements, Electrode-to–Tissue
Interactions. Redox and Immobilized Enzymes. Optical Sensors.

Course Objectives
Students should be acquainted with advanced methods in biomedical sensors.

Course Topics
- Electrochemical Biopotentials
- Membrane Electrodes
- Double Layer Structures Mass Transport and Ion Migration
- Hydrodynamic Electrodes
- Cyclic Voltametryarid
- Neuroscience Applications
- Low-current Measurements
- Electrode-to–Tissue Interactions
- Redox and Immobilized Enzymes
- Optical Sensors

Prerequisites
BE 716: Biomedical Measurements

References
- J.G. Webster, "Medical Instrumentation: Application and Design," Houghton
  Mifflin, 1992
Course Detailed Structure

Electronics and Communications Engineering

Course Code : BE 722
Course Title : Biomedical Seminar
Credit Hours : 3

Course Description
Special Topics Related to Advanced Biomedical Engineering. Analysis of Data Conclusions and Presentation Reports are advanced in details.

Course Objectives
Gain the ability to prepare and present talks on advanced topics in engineering.

Course Topics
- Special topics related to advanced biomedical engineering
- Analysis of data conclusions and presentation reports are advanced in details

Prerequisites
BE 711: Introduction to Biomedical Engineering

References
Course Detailed Structure

Electronics and Communications Engineering

Course Code : BE 723
Course Title : Neural Networks
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 be 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

Prerequisites
BE 718: Biomedical Signal Processing

References
- P.R. Lippman, J.E Moody, and D.S. Touretzky, “Advances in Neural Information
Course Code : BE 724

Course Title : Advanced Patient Monitoring and Safety

Credit Hours : 3

Course Description
Physiological Transducers, Electrophysiological Signal Acquisition and Analysis, Cardiovascular System Models, Pediatric Monitoring, Ambulatory Monitoring, Intensive Care Units, Safety of Biomedical Measurements.

Course Objectives
Students should be introduced to advanced patient and monitoring systems.

Course Topics
- Physiological Transducers
- Electrophysiological Signal Acquisition and analysis
- Cardiovascular system models
- Pediatric monitoring
- Ambulatory monitoring
- Intensive care units
- Safety of Biomedical measurements

Prerequisites
PE 716: Biomedical Measurements

References
Course Code : BE 725
Course Title : Telemedicine Networks
Credit Hours : 3

Course Description
Communication and Computer Systems with Applications to Medicine, Telemetry and Telecommunication Networks, Medical Features and Parameters for Telemedicine.

Course Objectives
Students should be introduced to technical principles and applications of telemedicine.

Course Topics
- Communication and computer systems with applications to medicine, telemetry and telecommunication networks
- Medical features and parameters for telemedicine

Prerequisites
BE 718: Biomedical Signal Processing

References
Course Code : BE 726
Course Title : Special Topics in Biomedical Engineering
Credit Hours : 3

Course Description
Selected Topics Dealing with Recent Advances and Developments in Biomedical Engineering.

Course Objectives
Students should be introduced to recent scientific research and development in Biomedical Engineering.

Course Topics
- Selected topics dealing with recent advances and developments in biomedical engineering

Prerequisites
BE 711: Introduction to Biomedical Engineering

References