The Faculty of Engineering offers (4) postgraduate programmes: list the programmes:

- **Academic Programmes:**

- **Degree, Programmes, Dual degree**

Master of Science (M.Sc.), Communication and Information Engineering, Dual degree

- **Professional Programmes:**

Master of Engineering (M.Eng.), Communication and Information Engineering, Dual degree.

Name of the Programme:

The communication and Information Engineering

1. **Bachelor's degree required for each programme / Required overall grade or GPA:**

- **M.Sc.:** Grade of “C” (Good) or Post Graduate Diploma from Faculty of Engineering if the Graduate grade is lower than”C”.
- **M.Eng.:** Grade of “D” (Pass).
- GPA to graduate is 2.70 (B-)

2. **Total number of credits for the programme is 40 creidts.**

3. **Programme structure**

The programme is distinctive through its partnership with London South Bank University, which is a British University fully accredited and recognised as Highly Trusted Sponsor by the UK Border Agency.

http://www.studylondon.ac.uk/universities?gclid=CMqkkcv88MYCFa3MtAodEsQGWQ

Curriculum Structure and Contents

No. of credit hours for MEng program: 40 credit hrs

16	hrs	Compulsory
18	hrs	Elective
6	hrs	Research project

Progression criteria

Progression Criteria:

- To join this programme the student may be required to study up to 9 credit hours of subjects, at the 500 level which he/she did not study before, as per the recommendation of the programme director and the students' engineering background, with a grade point average not less than (C+).
- Alternatively, the student may join this programme if he/she holds a postgraduate diploma grade point average not less than (C+).
- To progress the student should complete a total number of 34 credit hours with a grade point average not less than (B). The studied subjects should be at the 600 level. After completing 34 credit hours of taught modules, the student should complete 6 credit hours for his research project work and report writing.

Research Project Requirements**:**

A research report (6 credit hours) is equivalent to a project showing the student's ability to investigate a point related more to industry or field studies following the basic steps of data collection, analysis and results discussion.

Coding System

#	Programme	Code
1	Communications and Information Engineering	CIE

الرمز	القسم أو الشعبة: برنامج بينى	مسلسل
هتم	هندسة الاتصالات والمعلومات	1

Programme Description

The MEng. degree in Communications and Information Engineering consists of 40 credit hours distributed over a minimum of two years as follows:

Mandatory modules	16 hrs	6 Modules	25 %
Elective modules	18 hrs	6 Modules	58.3 %
Research Project	6 hrs		16.7 %
Total	40 hrs	12 Modules	100

List of Compulsory Modules

Code No.	Module Title	No. of units	No. of hours / week		
			Lec.	Tut.	Total
CIE601	Digital Communications Systems	3	2	2	3
CIE602	Advanced Digital Signal Processing	3	2	2	3
CIE603	Data Communication and Computer Networks	3	2	2	3
CIE604	Information Theory, InfeCIEce and Machine Learning	3	2	2	3
CIE605	Fundamentals of Finite Element	2	2	1	2
CIE606	Technical Writing	2	2		2
	Total	16 credits			

List of Elective Modules

Code No.	Module Title	No. of Credit hrs	No. of hours week	
			Lec	Tut.
CIE607	Information Theory and Coding	3	2	2
CIE608	Advanced Topics in Antennas and Wireless Propagation	3	2	2
CIE609	Advanced Wireless Communications	3	2	2
CIE610	Optical Communication Systems	3	2	2
CIE611	Communications Electronics	3	2	2
CIE612	Microwave Communication Technology	3	2	2
CIE613	Selected Topics in Communications Engineering	3	2	2
CIE614	Quantum Computing	3	2	2
CIE615	Image Processing and Computer Vision	3	2	2
CIE616	Computer and Network Security	3	2	2
CIE617	Multimedia Communication Systems	3	2	2
CIE618	Pattern Analysis and Machine Learning	3	2	2
CIE619	Wireless Sensor Networks	3	2	2
CIE620	Big Data Analytics (from Computer Science)	3	2	2
CIE621	Selected Topics in Computer and Information Engineering	3	2	2

List of Compulsory Elective Modules

CIE622	Research project	6 credits

Curriculum Structure and Contents

No. of credit hours for MSc program: 40 credit hrs.

16	hrs	Compulsory
6	hrs	Elective
18	hrs	Thesis

Progression criteria

Progression Criteria:

- To join this programme the student may be required to study up to 9 credit hours of modules, at the 500 level which he/she did not study before, as per the recommendation of the programme director and the students' engineering background, with a grade point average not less than (C+).
- Alternatively, the student may join this programme if he/she holds a postgraduate diploma with a grade point average not less than (C+).
- To progress the student should complete a total number of 22 credit hours with a grade point average not less than (B), at the 600 level.
- After completing 22 credit hours of taught modules, the student should complete 18 credit hours for his research work and thesis writing.

Thesis Requirements:

An MSc thesis (18 credit hours) should reflect that the student is capable of collecting and integrating data from a number of sources relevant to the state of the art, followed by critical review of previous studies. Hence the student is expected to define and state the problem of investigation, deduce a plan of work for the thesis, defining and describing the methodology of research.

A written thesis is required which shows the basic elements of state of the art, methodology of research and results and discussion sections, in addition to a conclusion.

Coding System

#	Programme	Code
1	Communications and Information Engineering	CIE

مسلسل	القسم أو الشعبة: برنامج بينى	الرمز
1	هندسة الاتصالات والمعلومات	هتم

Programme Description

The MSc. degree in Communications and Information Engineering consists of total 40 credit hours distributed over a minimum of 2 years as follows:

Compulsory modules	16 hrs	6 modules	40 %
Elective modules	6 hrs	2 modules	15 %
Thesis	18 hrs		45 %
Total	40 hrs	8 modules	100 %

List of Compulsory Modules

Code No.	Module Title	No. of units	No. of hours / week		
			Lec.	Tut.	Total
CIE601	Digital Communications Systems	3	2	2	3
CIE602	Advanced Digital Signal Processing	3	2	2	3
CIE603	Data Communications & Computer Networks	3	2	2	3
CIE604	Information Theory, Inference and Machine Learning	3	2	2	3
CIE605	Fundamentals of Finite Element	2	2	1	2
CIE606	Technical Writing	2	2		2
	Total	16 credits			

List of Elective Modules

Code	Module Title	No. of Credit hrs	No. of hours / week	
			Lecture	Tut.
CIE607	Information Theory and Coding	3	2	2
CIE608	Advanced Topics in Antennas and Wireless Propagation	3	2	2
CIE609	Advanced Wireless Communications	3	2	2
CIE610	Optical Communication Systems	3	2	2
CIE611	Communications Electronics	3	2	2
CIE612	Microwave Communication Technology	3	2	2
CIE613	Selected Topics in Electronics and Communications Engineering	3	2	2
CIE614	Quantum Computing	3	2	2
CIE615	Image Processing and Computer Vision	3	2	2
CIE616	Computer and Network Security	3	2	2
CIE617	Multimedia Communication Systems	3	2	2
CIE618	Pattern Analysis and Machine Learning	3	2	2
CIE619	Wireless Sensor Networks	3	2	2
CIE620	Big Data Analytics (from Computer Science)	3	2	2
CIE621	Selected Topics in Computer and Information Engineering	3	2	2

List of Compulsary Modules

CIE624	Research Thesis	18		18	ALL

Small brief of each module

A- Level 500

CIE 501 **Communications Systems**

Introduction to communication systems - Power spectral density - Amplitude Modulation suppressed carrier - Amplitude modulation large carrier - Single side band - Vestigial side band - Demodulation of amplitude modulation (DSB-SC, DSB-LC, SSB-SC, SSB-LC) - Angle modulation - Narrow band F.M.-Wide band F.M. - Phase Modulation - Demodulation of angle modulation - AM and FM receivers – FDM - Pulse Modulation (PAM, PWM, PPM) –TDM - Noise in analog modulation systems- Introduction to digital communication systems - Applications

CIE 502 **Digital Signal Processing**

Fundamentals Linear Time-Invariant (LTI) discrete-time systems, Linear and Circular convolution, Infinite-impulse response filters, Finite-impulse response filters, The Discrete-Time Fourier transform (DFT), Fast Fourier Transform (FFT), DSP Applications.

CIE 503 **Communication Networks**

Introduction to communication network, network topology and architecture LAN, WAN, circuit switching, packet switching-The ISO and TCP/IP reference models -Circuit switching, packet switching- The physical layer transmission media, signal encoding- The Datalink layer; framing, switching, local area network, Ethernet and frame structures-The Network Layer; IP addressing, routing, and forwarding-
The Transport Layer, UDP, TCP, connection oriented and connectionless data transfer

B- Level 600 (Core)

CIE 601 **Digital Communications Systems**

Review of Signals and Spectra (power/energy spectral densities, autocorrelations, review random processes and stochastic signal calculations, bandwidth criteria, and LTI systems in the context of random signals) – Baseband (Pulse) Modulations (conversion, oversampling, ISI, Sources of Corruption and Performance Degradation, lines codes PCM, M-ary BB modulation, etc.) – Baseband Detection and Demodulations (Signal representation in vector space, orthogonalization, Signal and noise effects, Performance criteria, Detection in AWGN channels, ISI, Equalisation, etc.)– Bandpass Modulation and Demodulation/Detection (Modulations schemes, detection in noise, Coherent detection, Noncoherent detection, Complex envelopes, Error performance in Binary systems and in M-ary systems, etc.) – Link Analysis – Review/applications of Channel Coding [with attention to topics given in Information Theory and Coding module] (Types of channel codes, Linear Block Codes, Cyclic, Galoy, BHC, Hamming Codes, Convolutional Codes, Viterbi Decoding, Reed-Solomon Codes, Interleaving Codes, Turbo Codes) – Modulation and Coding Tradeoffs in Digital Communications – Synchronization – Multiplexing and Multiple-Access – Spread Spectrum Techniques – Encryption and Decryption Review – Fading Channels techniques.

CIE 602 **Advanced Digital Signal Processing**

Spectrum estimation and analysis- Parametric modeling methods-Adaptive Filters-Adaptive noise canceling -Multirate digital signal processing- Cepstral Analysis- Bispectral Analysis and Higher-order Statistics- Time-frequency analysis, the short time Fourier transform, and wavelet transforms.

CIE 603 **Data Communications and Computer Networks**

Introduction to data communications and computer network concepts – Network Architecture - Layer Functionality and Design Issues – Fundamentals of data transmission- Data Encoding & Communication Techniques - Multiplexing and Switching - packet switching and circuit switching – Data Link Layer Fundamentals – Retransmission Strategies - Contention-based Media Access Protocols – Media Access Control Protocols for High Speed Networks – Network Layer - Routing Algorithms and traffic engineering mechanisms – Multicast routing – Mobile IP – IPv6 - Internet-Transport Services and Mechanism - Congestion Control Algorithms TCP – STCP and multihoming - Application layer protocols – DNS – HTTP – FTP – STMP – P2P - Content Based Networks (CDNs) – Multimedia transmission and Data Streaming –Quality of Service (QoS) –Network security .

CIE 604 **Information Theory, Inference and Machine**

The Source Coding Theorem– Symbol Codes – Stream Codes– Communication over a Noisy Channel– The Noisy Channel Coding Theorem - Noisy-channel coding theorem and coding practice-Error-Correcting Codes and Real Channels– Selected Topics (Hash codes, Binary Codes, Very Good Linear Codes Exist, Message Passing, and Constrained Noiseless Channels) – Exact Marginalization (Exact Marginalization, (in Trellises and in Graphs)) - Low-Density Parity-Check Codes – Convolution Codes – Turbo Codes – Digital Fountain Codes- Probability and Inference: Clustering , Exact Inference by Complete Enumeration, Maximum Likelihood and Clustering, Useful Probability Distributions, Exact Marginalization, Laplace's Method, Monte Carlo Methods, Bayesian Inference and Sampling Theory, Sparse Graph Codes. Machine Learning- Learning as Inference.

CIE 605 **Fundamentals of Finite Element Methods**

Basic concepts and field equations of interest- Variational Formulation & Approximation- Finite Elements Analysis of One-Dimensional and Two-Dimensional Problems.

CIE 606 **Technical Writing**

Research methods- Writing Techniques-General form of a research paper -General style- Title Page -Abstract -Introduction- Literature Review - Materials and Methods (Methodology)- Results- Discussion- Conclusion- Recommendation and Future Work**.**

CIE607 **Information Theory and Coding**

Introduction: Probability, Uncertainty and Information- **Information Theory:** Measure of information, Entropy, Relative Entropy, Mutual Information, Asymptotic Equipartition Property- **Source Coding:** Shannon Coding, Huffman Coding, Discrete Channels, Continuous Channels, Channel Capacity-**Channel Coding:** Error-Correcting Codes, Linear Block codes, Cyclic Codes, Convolutional Codes- Joint Source-Channel Coding.

CIE 608 **Advanced Topics in Antennas and Wireless Propagation**

Propagation of electromagnetic waves (free space, earth propagation, ground waves, space waves, surface waves, line of sight conditions, impact of obstacles)-Troposphere diffusion, refraction, multipath propagation, aliasing, differential receiving. Ionosphere Propagation and ionosphere refraction, reflection, Friis equation, equation of the Radar-One-way and two-way links, point to point links, point to-multi point links, link budget, bandwidth and capacity-Radio communication design, power balance, interference, measurements on radio communication links, electromagnetic field measurement methods (broadband and narrowband) on modern wireless broadband radiocommunication systems-Fourier transforms in antennas, displacement theorem, amplitude tapers and sidelobe levels, orthogonality, pattern synthesis, near and far field patterns and focused apertures, interferometers-Linear arrays, the product theorem, frequency-scanned arrays, phase and time delay compensation, null steering, switched-line phase shifter and sidelobe levels-Vector modulators and multiple beamforming arrays, smart antenna systems in mobile applications, reflector and lens antennas including the feed systems, antenna measurements and anechoic chambers.

CIE 609 **Advanced Wireless Systems**

The wireless channel- Point-to-point communication: detection, diversity and channel uncertainty- Cellular systems: multiple access and interference management- Capacity of wireless channels- Multiuser capacity and opportunistic communication- MIMO I: spatial multiplexing and channel modelling- MIMO II: capacity and multiplexing architectures- MIMO III: diversity-multiplexing trade-off and universal space-time codes.

CIE 610 **Optical Communication Systems**

Advanced chromatic dispersion compensation, PMD compensation and nonlinearity management. Spectral efficiency limits will be described as will techniques to achieve them, such as turbo equalization, forward error correction and coded modulation. Advanced modulation formats, such as various multilevel modulations and OFDM, and constrained coding techniques suitable to deal with fiber nonlinearities. The physics behind parametric amplification, as well as its application to all-optical regeneration, wavelength conversion and multibanded switching. Other topics include soliton and dispersion-managed soliton transmission.

CIE611 **Communication Electronics**

Transmitter and receiver fundamentals of analogue communication systems. Design of mixers, converters, RF and IF amplifiers. Passive and active filter design. Design of oscillator circuits of different types. Analysis and design of AM modulators and demodulators. Frequency modulators, phase modulators and frequency demodulators. Design of video IF amplifiers, synchronizers, separators, and voltage control oscillators. Introduction to basic antennas.

CIE 612 **Microwave Communication Techniques**

Review of Maxwell's Equation, Plane wave, Guided wave, Smith chart, and s-parameters. Microstrip and co-planar waveguide transmission lines. Single and double stub matching. Introduction of passive microwave components (capacitors, resistors, inductors). Design of microwave filters. Microstrip resonators, directional coupler, patch antennas and power divider (Wilkinson, Rat-race etc). Microwave ferrite materials. Microwave Transistors.

Biasing of Microwave amplifiers. Matching network for an amplifier. Gain of an amplifier. Microwave oscillator design. Microwave radio link. Microwave tubes and oscillator. Introduction to microwave measurements (network analyser).

CIE 613 **Selected Topics in Electronics and Communications Engineering**
Independent study in various problem areas of electronics and communications engineering may be assigned to individual students or to groups. Readings assigned and frequent consultations held. May be repeated for credit if content changes.
Prerequisite: consent of instructor

CIE 614 **Quantum Computing**
Quantum mechanics to understand quantum computation- Quantum algorithms- Simon's algorithm- The prime factorization algorithm- Grover's search algorithm- Mathematical models of quantum computation, their relationships to each other, and to physical systems- Quantum error correcting codes-Quantum cryptography- Quantum fault tolerance- Quantum logic gates.

CIE 615 **Image Processing and Computer Vision**
Overview of image processing systems, Image formation and perception, Continuous and digital image representation-Image quantization: uniform and nonuniform, visual quantization (dithering)-Image contrast enhancement: linear and non-linear stretching, histogram equalization- Image smoothing and image sharpening by spatial domain linear filtering; Edge detection- Discrete Fourier transform in 1D and 2D, and image filtering in the DFT domain- Median filtering and Morphological filtering-Color representation and display; true and pseudo color image processing-Image sampling and sampling rate conversion (resize)-Lossless image compression: The concept of entropy and Huffman coding; Runlength coding for bi-level images; CCITT facsimile compression standards-Lossy image compression: Image quantization revisited; Predictive coding; Transform coding; JPEG image compression standard-Imaging Geometry; Coordinate transformation and geometric warping for image registration-Object recognition.

CIE 616 **Computer and Network Security**
OSI Security Architecture - Classical Encryption techniques – Cipher Principles – Data Encryption Standard – Block Cipher Design Principles and Modes of Operation - Evaluation criteria for AES – AES Cipher – Triple DES – Placement of Encryption Function – Traffic Confidentiality- Public Key Cryptography- Authentication and Hash Function: Authentication requirements – Authentication functions – Message Authentication Codes – Hash Functions – Security of Hash Functions and MACs – MD5 message Digest algorithm - Secure Hash Algorithm – RIPEMD – HMAC Digital Signatures – Authentication Protocols – Digital Signature Standard, Network Security: Authentication Applications: Kerberos – X.509 Authentication Service – Electronic Mail Security – PGP – S/MIME - IP Security – Web Security, System Level Security: Intrusion detection – password management – Viruses and related Threats – Virus Counter measures – Firewall Design Principles – Trusted Systems.

CIE 617 **Multimedia Communication Systems**
Introduction to Multimedia Systems and Standards- Audio-Video Analysis and Retrieval: Content-based Image Retrieval- Content-based Video Retrieval: Scene Break Detection, Multimedia Information Security and Digital Rights Management (DRM)- Audiovisual Data Confidentiality, Integrity and Copyright Protection- Overview of Traditional Telephony

Networks- Overview of Packet Telephony Networks- Analog Voice Fundamentals- Voice Codec- Signalling Systems- Voice Interface Configuration- Voice Dial Peer Configuration- Understanding VoIP Requirements- VoIP Network Architectures- Building Scalable Dial Plans- Calculating Bandwidth Requirements- Voice Quality Evaluation- Factors that Affect Voice Quality- Queuing Policies- Traffic Policing and Shaping- Fragmentation and Interleaving- RSVP and DiffServ- The Need for Signaling and Call Control- H.323 Concepts and Configuration- SIP Concepts and Configuration- MGCP Concepts and Configuration- Comparing Call Control Models.

CIE 618 **Pattern Analysis and Machine Intelligence**

Introduction to the foundation of pattern analysis and machine intelligence. Artificial intelligence: agent, logic, search. Machine learning: Bayesian techniques, kernel-based methods, support vector machine. Pattern recognition: statistical regression and classification. Neural network: backpropagation, simulated annealing. Imaging: image segmentation, object recognition.

CIE 619 **Wireless Sensor Networks**

Introduction to wireless networks, architectures and technologies- Wireless sensor network platforms: Hardware and Software- Communication architecture and protocols for WSN (MAC, Link, Routing)- Energy management- Sensor data acquisition, processing and handling- Signal processing, target localization and tracking, self-organization- Modeling and Simulation of WSN- Application case studies (health, environmental monitoring, smart home).

CIE 620 **Big Data Analytics**

Scalable data management architectures- Overview of data-parallel problems -Patterns and technology for exploiting cloud infrastructure on data-parallel problems- Graph databases and their application to engineering analysis -Scalable real-time data processing data mining alongside machine learning techniques (e.g. clustering, regression, support vector machines, boosting, decision trees and neural networks).

CIE 621 **Selected Topics in Computer and Information Engineering**

Independent study in various problem areas of Information technology may be assigned to individual students or to groups. Readings assigned and frequent consultations held. May be repeated for credit if content changes.

Prerequisite: consent of instructor

CIE 622 **Research Project**

To be proposed and approved by academic advisor

CIE 623 **Research Thesis**

To be proposed and approved by academic advisor.

Contact information

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For more information

1. Required documents: https://www.bue.edu.eg/general-requirements
2. English Level: https://www.bue.edu.eg/uploads/editor/PG%20English%20Level_Web%20site.pdf
3. PG Tuition Fees: https://www.bue.edu.eg/tuition-feess
4. PG Scholarship Scheme: https://www.bue.edu.eg/postgraduate-scholarships
5. Application link: https://pgs.bue.edu.eg/registration/Default.aspx