Academic Reference Standards (ARS)

for

Electronics and Communications Engineering

B. Sc. Program

Faculty of Engineering,

Mansoura University

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Contents

Introduction

Electronics and Communications are important fields in modern engineering. The discipline deals with electronic devices and software interfaces. They include microelectronic systems, microcontrollers, mobile communications, wireless networks, satellite systems and the internet. The industry ranges from companies that conduct fundamental research and development into future technologies, through to others that design and deploy state of the art technologies. The electronics and communications industry has a shortage of skilled electronic and electrical engineers, meaning that career opportunities are excellent for capable graduates.

This program gives the students the specialist skills and knowledge necessary to begin an exciting and rewarding career in the communications industry. The student will learn fundamental electronic engineering along with specialist communications topics such as optical and radio-frequency engineering, digital signal processing, network protocols/technologies and the design and optimization of networks. Students study a very wide range of real world communication systems, including fibre-optic communications, cellular mobile systems such as UMTS (3G) and LTE (4G), digital terrestrial and satellite broadcast systems (e.g. DAB, Free view and Sky) and a range of wired and wireless internet technologies such as WiFi, Ethernet, ADSL and WiMAX.

The tasks of the Electronics and Communication engineers are to direct, control and test produce processes a well as to ensure safety, installation and functioning of the various mechanisms. One of the basic work that are involved by the engineers include research and development of satellite, design, cable systems, radio waves, mobile phones, internet, etc. They also work on improving the functionality and technology of communication devices and servers. Setting up networks and equipments and maintain the systems are also among their job profile.

He can work in the consumer electronics, aviation and avionics, manufacturing, electricity generation and distribution, communications, transportation, telecommunications, radio and television, computer applications, hospital diagnostic equipment and offshore industries.

National Academic Reference Standards (NARS) for Engineering

Attributes of the graduates

The graduates of the engineering programs should be able to:

1. Apply knowledge of mathematics, science and engineering concepts to the solution of engineering problems.
2. Design a system; component and process to meet the required needs within realistic constraints.

3. Design and conduct experiments as well as analyze and interpret data.
4. Identify, formulate and solve fundamental engineering problems.
5. Use the techniques, skills, and appropriate engineering tools, necessary for engineering practice and project management.
6. Work effectively within multi-disciplinary teams.
7. Communicate effectively.
8. Consider the impacts of engineering solutions on society and environment.
9. Demonstrate knowledge of contemporary engineering issues.
10. Display professional and ethical responsibilities; and contextual understanding.
11. Engage in self- and life- long learning.

1. Knowledge and Understanding

The graduates of the engineering programs should be able to demonstrate the knowledge and understanding of:

1.1. Concepts and theories of mathematics and sciences, appropriate to the discipline.

1.2. Basics of information and communication technology (ICT).

1.3. Characteristics of engineering materials related to the discipline.

1.4. Principles of design including elements design, process and/or a system related to specific disciplines.

1.5. Methodologies of solving engineering problems, data collection and interpretation.

1.6. Quality assurance systems, codes of practice and standards, health and safety requirements and environmental issues.

1.7. Business and management principles relevant to engineering.

1.8. Current engineering technologies as related to disciplines.

1.9. Topics related to humanitarian interests and moral issues.

1.10. Technical language and report writing.

1.11. Professional ethics and impacts of engineering solutions on society and environment.

1.12. Contemporary engineering topics.

2. Intellectual Skills

The graduates of the engineering programs should be able to:

2.1. Select appropriate mathematical and computer-based methods for modeling and analyzing problems.

2.2. Select appropriate solutions for engineering problems based on analytical thinking.

2.3. Think in a creative and innovative way in problem solving and design.

2.4. Combine, exchange, and assess different ideas, views, and knowledge from a range of sources.

2.5. Assess and evaluate the characteristics and performance of components, systems and processes.

2.6. Investigate the failure of components, systems, and processes.

2.7. Solve engineering problems, often on the basis of limited and possibly contradicting information.

2.8. Select and appraise appropriate ICT tools to a variety of engineering problems.

2.9. Judge engineering decisions considering balanced costs, benefits, safety, quality, reliability, and environmental impact.

2.10. Incorporate economic, societal, environmental dimensions and risk management in design.

2.11. Analyze results of numerical models and assess their limitations.

2.12. Create systematic and methodic approaches when dealing with new and advancing technology.

3. Practical and Professional Skills

The graduates of the engineering programs should be able to:

3.1. Apply knowledge of mathematics, science, information technology, design, business context and engineering practice integrally to solve engineering problems.

3.2. Professionally merge the engineering knowledge, understanding, and feedback to improve design, products and/or services.

3.3. Create and/or re-design a process, component or system, and carry out specialized engineering designs.

3.4. Practice the neatness and aesthetics in design and approach.

3.5. Use computational facilities and techniques, measuring instruments, workshops and laboratory equipment to design experiments, collect, analyze and interpret results.

3.6. Use a wide range of analytical tools, techniques, equipment, and software packages pertaining to the discipline and develop required computer programs.

3.7. Apply numerical modeling methods to engineering problems.

3.8. Apply safe systems at work and observe the appropriate steps to manage risks.

3.9. Demonstrate basic organizational and project management skills.

3.10. Apply quality assurance procedures and follow codes and standards.

3.11. Exchange knowledge and skills with engineering community and industry.

3.12. Prepare and present technical reports.

4. General and Transferable Skills

The graduates of the engineering programs should be able to:

4.1. Collaborate effectively within multidisciplinary team.
4.2. Work in stressful environment and within constraints.
4.3. Communicate effectively.
4.4. Demonstrate efficient IT capabilities.
4.5. Lead and motivate individuals.
4.6. Effectively manage tasks, time, and resources.
4.7. Search for information and engage in life-long self learning discipline.
4.8. Acquire entrepreneurial skills.
4.9. Refer to relevant literatures.

Curriculum Structure

Subject Areas	Percentage	Tolerance
Humanities and Social Sciences	11 %	9 - 12 %
Mathematics and Basic Sciences	21 %	20 - 26 %
Basic Engineering Sciences	21 %	20 - 23 %
Applied Engineering and Design	21 %	20 - 22 %
Computer Applications and ICT*	10 %	9 - 11 %
Projects and Practice*	9 %	8 - 10 %
Subtotal	**93 %**	**92 - 94 %**
Discretionary (Institution character-identifying) subjects	7 %	6 - 8 %
Total	**100 %**	**100 %**

* This part of the curriculum may be served in separate course(s) and/or included in several courses and its hours should be indicated in the course specification.

Definition of Subject Areas

Humanities and Social Sciences

i. Acquiring knowledge of non-engineering fields that strengthen the consciousness of the engineer of the society and its culture, including business, marketing, environmental, welfare, ethics, law, arts, etc.

ii. The ability to consider and evaluate the impact of the technology on the society, public health and safety.
iii. The ability to appreciate and engage in social and entrepreneurial activities essential to the engineering practice and reflect on the management of the economics and social science
iv. The ability to engage in life-long learning and respond effectively to the needs of the society.

Mathematics

i. Acquiring knowledge in mathematical and analytical methods.
ii. The ability to reason about and conceptualize engineering components, systems or processes using analytical methods related to the discipline.
iii. The ability to analyze and model engineering components, systems and processes specific to the discipline.
iv. The skills of using probability and statistical methods.

Basic Sciences

i. Acquiring knowledge of physics, chemistry, mechanics, earth sciences, biological/ medical sciences and other specific subjects, which focus on understanding the physical world.
ii. The ability to select and apply scientific principles in practical problem solving.
iii. The ability to analyze, model and reason about engineering components, systems or processes using principles and

knowledge of the basic sciences as applicable in each engineering disciplinary context.

iv. The ability to adopt scientific evidence-based techniques in problem solving.

Basic Engineering Sciences

i. Integrating knowledge and understanding of mathematics and physical sciences to develop basic engineering laws and concepts related to the discipline.

ii. The ability to extend knowledge and develop models and methods and use techniques, principles and laws of engineering sciences that lead to engineering applications across disciplinary boundaries.

iii. The ability to deal effectively with numbers and concepts to identify/solve complex and open ended engineering problems.

Applied Engineering and Design

i. Attaining knowledge of current practice, engineering codes and design techniques relevant to the discipline.

ii. The ability to apply engineering knowledge and creative, iterative and open-ended procedures when conceiving and developing components, systems and processes.

iii. The ability to integrate engineering knowledge, engineering codes, basic and mathematical sciences in designing a component, a system or a process.

iv. The ability to work under stress, taking into account time, economy, health and safety, social and environmental factors and binding laws.

Computing and ICT

i. Attaining knowledge of ICT principles.
ii. The ability to use computers, networks and software to support engineering activity, and to enhance personal/team productivity.
iii. The ability to assess, use and validate results produced by packages and create software as required in discipline.
iv. The ability to use general ICT tools effectively.

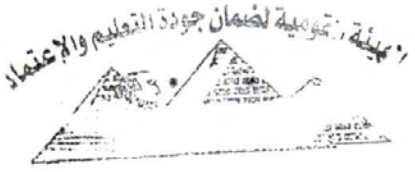
Project

i. Gaining the knowledge and experience of applying the different principles and techniques introduced in the program of study.
ii. The ability to work within defined constraints, tackle work which lacks a well-defined outcome or which has a wide range of possible solutions and exhibit creativity in dealing with unfamiliar real-life problems.
iii. The ability to investigate, plan and execute technical research specific to the discipline over an extended period of time; meeting deadlines and putting technical work in a social and commercial context.

iv. The ability to work in a team, search published sources of information, interprets technical data and analyzes and presents findings in various ways.

Discretionary Subjects

i. Attaining knowledge and understanding of subjects selected by the institution to identify its character and/or satisfy the needs of the society.
ii. The ability to recognize, appreciate and respond effectively to the needs of the society via utilizing the technical knowledge specific to the discipline.
iii. The ability to lead and motivate people as well as organize and control tasks, people and resources.



Academic Reference Standards (ARS) for Electronics and Communications Engineering

The Attributes of Electronics and Communications Engineering graduates

In addition to the general attributes of Engineering graduates, the Electronics and Communications Engineering graduates should be able to:

1. Integrates knowledge based on digital electronics and logic design, fundamentals of communication engineering, electronic circuits, signals and systems, power electronics, applied electromagnetic theory, integrated circuits, VLSI, control systems and computer architecture.
2. Manipulate with the electronic circuits, all the way from the discrete components level, circuits analysis and design, to the troubleshooting with emphasis on electronic power devices.
3. Apply control theory and measurement principals for industrial variables, signal conversion, conditioning and processing.
4. Deal with the computer's hardware, software, operating systems and interfacing.
5. Design, operate and maintain digital and analog communication, mobile communication, coding, and decoding systems.
6. Planning and analyzing communication networks.

7. Adapt to new telecommunication technologies.
8. Deal with high frequency techniques.

1. Knowledge and Understanding

In addition to the knowledge and understanding of Engineering graduates, the Electronics and Communications Engineering graduates should demonstrate knowledge and understanding of:

1.1. Elementary science underlying electronic engineering systems and information technology.
1.2. Basics of design and analyzing electronic engineering systems, while considering the constraints of applying inappropriate technology and the needs of commercial risk evaluation.
1.3. Principles of Analyzing and design of electronic circuits and components of Communication systems.
1.4. Principles of Analyzing and design of control systems with performance evaluation.
1.5. Biomedical instrumentation.
1.6. Communication systems.
1.7. Coding and decoding techniques.
1.8. Microwave applications.
1.9. Antenna and wave propagation.
1.10. Nanotechnology application.
1.11. Usage of optical fiber.
1.12. Methods of fabrication of Integrated circuits.

1.13. Analysis of signal processing.
1.14. Optical communication systems.
1.15. Satellite communications.
1.16. Wireless communication techniques.

2. Intellectual Skills

In addition to the intellectual skills of Engineering graduates, the Electronics and Communications Engineering graduates should be able to:

2.1. Develop innovative solutions for the practical industrial problems.
2.2. Plan, conduct and write a report on a project or assignment.
2.3. Analyze the performance of digital and analog communication, mobile communication, coding, and decoding systems.
2.4. Synthesis and integrate electronic systems for certain specific function using the right equipment.
2.5. Analyze Communication Networks.

3. Practical and Professional Skills

In addition to the practical and professional skills of Engineering graduates, the Electronics and Communications Engineering graduates should be able to:

3.1. Use appropriate mathematical methods or IT tools.

3.2. Practice computer programming for the design and diagnostics of digital and analog communication, mobile communication, coding, and decoding systems.
3.3. Use relevant laboratory equipment and analyze the results correctly.
3.4. Troubleshoot, maintain and repair electronic and communication systems using the standard tools.
3.5. Identify appropriate specifications for required devices.
3.6. Use appropriate devices and tools to measure electronic and communication systems performance and parameters.

4. General and Transferable Skills

The graduates should be able to demonstrate general and transferable skills of Engineering graduates.

Glossary

1. **Institution**

   A University, Faculty or higher institute providing education programs leading to a first university degree or a higher degree (Master or Doctorate).

2. **Attributes of the Graduates**

   Competencies expected from the graduates based on the acquired knowledge and skills gained upon completion of a particular program.

3. **National Academic Reference Standards (NARS)**

   Reference points designed by NAQAAE to outline/describe the expected minimum knowledge and skills necessary to fulfill the requirements of a program of study.

4. **Academic Standards**

   Reference points defined by an institution comprising the collective knowledge and skills to be gained by the graduates of a particular program. The academic standards should surpass the NARS, and be approved by NAQAAE.

5. **Subject Benchmark Statements**

   Guideline statements that detail what can be expected of a graduates in terms of the learning outcomes to satisfy the standards set for the program. They enable the outcomes to be compared, reviewed and evaluated against agreed upon standards.

6. The Program

A set of educational courses and activities designed by the institution to determine the systematic learning progress. The program also imparts the intended competencies required for the award of an academic degree.

7. Intended Learning Outcomes (ILOs)

Subject-specific knowledge, understanding and skills intended by the institution to be gained by the learners completing a particular educational activity.. The ILOs emphasize what is expected that learners will be able to do as a result of a learning activity.

8. Knowledge and Understanding

Knowledge is the intended information to be gained from an educational activity including facts, terms, theories and basic concepts. Understanding involves comprehending and grasping the meaning or the underlying explanation of scientific objects.

9. Intellectual Skills

Learning and cognitive capabilities that involve critical thinking and creativity. These include application, analysis, synthesis and evaluation of information.

10. Professional and Practical Skills

Application of specialized knowledge, training and proficiency in a subject or field to attain successful career development and personal advancement.

11. General and Transferable Skills

Skills that are not subject-specific and commonly needed in education, employment, life-long learning and self development.. These skills include communication, team work, numeracy, independent learning, interpersonal relationship, and problem solving... etc.