



# Academic standards of Faculty of Engineering

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## Introduction

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The Faculty of engineering academic standards sets out generic statements which represent general expectations about standards for the Bachelor of Science (B.Sc.) degree in Engineering. These statements clarify the attributes associated with the award of engineering degree :

- The awards are in accord with the frameworks for contemporary engineering education.
- The Engineering degrees address the national expectations of the graduate engineers.
- The degrees satisfy the actual and expected market needs.

## Academic Standards For Engineering

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Faculty of Engineering Assiut University aims to have graduates which must be competent throughout their working life by virtue of their education, training and experience. Graduate of FOE-AU have the attributes that stated in the national academic reference standards (NARS)

### 2.1 THE ATTRIBUTES OF THE ENGINEER

The FOE engineer must have the ability to :

- a) Apply knowledge of mathematics, science and engineering concepts to the solution of engineering problems .
- b) Identify, formulate and solve engineering problems.
- c) Exploit the techniques, skills and up-to-date engineering tools, necessary for engineering practice.
- d) Design a system, component and process to meet the required needs within realistic constraints
- e) Consider the detrimental impact of engineering solutions on society and environment.
- f) Design and conduct experiments and analyze and interpret data.
- g) Demonstrate knowledge of contemporary engineering issues.

- h) Work efficiently within multi-disciplinary teams.
- i) Display professional responsibilities and ethical, societal and cultural concerns
- j) Communicate effectively.
- k) Recognize the need to engage in self- and life-long learning
- l) Manage engineering projects subjected to economic, environmental and social constraints .
- m) Fulfill requirements of potential employers

## **2.2 FOE-AU ACADEMIC REFERENCE STANDARDS :**

The academic reference standards represent the general expectations about the qualifications, attributes and capabilities that graduates of the engineering programs must be able to demonstrate:

### **2.2.1 Knowledge and Understanding:**

Acquiring knowledge and understanding of:

- a) Concepts and theories of mathematics and sciences, appropriate to the discipline.
- b) Basics of information and communication technology (ICT)
- c) Principles of design including elements design, process and/or a system related to specific disciplines.
- d) Methodologies of solving engineering problems.
- e) Professional ethics and socio-economical impact of engineering solutions
- f) Current engineering technologies as related to disciplines.
- g) Quality assurance systems, codes of practice and standards, health and safety requirements and environmental issues.
- h) Business and management principles relevant to engineering.
- i) Contemporary engineering topics.
- j) Topics related to humanitarian interests and moral issues.
- k) The impact of engineering solutions in a global and societal context;

### **2.2.2 Intellectual Skills**

The ability to:

- a) Select appropriate mathematical and computer-based methods for modeling and analyzing problems.
- b) Design and/or create a process, component or system applying appropriate knowledge and principles
- c) Select appropriate solutions for engineering problems based on analytical thinking
- d) Consider the applicability, economy and risk management in design.
- e) Assess and evaluate effectively the characteristics and performance of components, systems and processes
- f) Solve engineering design and production problems, often on the basis of limited and possibly contradicting information;
- g) Analyze results of numerical models and appreciate their limitations.
- h) Maintain a systematic and methodic approach in dealing with new and advancing technology,
- i) Reach engineering judgments considering balanced costs, benefits, safety, quality, reliability, and environmental impact.
- j) Analyze systems, processes and components critically.
- k) Select and appraise appropriate ICT tools to a variety of engineering problems.

### **2.2.3 Practical and Professional Skills**

The ability to:

- a) Integrate knowledge of mathematics, science, information technology, design, business context and engineering practice to solve engineering problems
- b) Employ computational facilities, measuring instruments, workshops and laboratories equipment to design experiments and collect, analyze and interpret results.
- c) Merge engineering knowledge and understanding to improve design, products and/or services.
- d) Apply numerical modeling methods and/or appropriate computational techniques to engineering problems
- e) Implement comprehensive engineering knowledge and understanding and intellectual skills in projects
- f) Commercialize knowledge and skills to engineering community and industry

- g) Apply safe systems at work.
- h) Prepare and present technical material.
- i) Demonstrate project management skills
- j) Appreciate the neatness and aesthetics in design and approach.

#### **2.2.4 General and Transferable Skills**

The ability to:

- a) Collaborate effectively within multidisciplinary team.
- b) Work in stressful environment and within constraints.
- c) Communicate effectively.
- d) Demonstrate efficient IT capabilities.
- e) Lead and motivate individuals.
- f) Manage tasks and resources.
- g) Search for information and adopt life-long self learning.
- h) Acquire entrepreneurial skills.

#### **Ethical standards or code of ethics:**

Graduates should appreciate and gain the following ethics through the practice of the profession as well encourage, by advice and example, others to adhere to these standards:

- undertake only such work as they are competent to perform by virtue of their training and experience.
- will not deliberately misrepresent qualifications or abilities they do not possess at the expense of the employer, clients or colleagues.
- protect, to the fullest extent, the interests of their employers and provide protection for the public's welfare.
- shall, at all times, discourage exaggerated statements concerning any project for which they are a part.
- will not directly or indirectly use any information confidential or otherwise, which is adverse or detrimental to the interests of the employer or client.
- will be cognizant of national and governmental statutes pertaining to the practice of engineering in Egypt.

## Academic standards for the Mechatronics Eng. program

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### 3.1. Program Aims

Mechatronics and Robotics has come to mean the synergistic use of precision engineering, control theory, actuators and sensors, and information technology to design smart components and systems. Mechatronics is simply the application of the latest technologies to create more functional and adaptable products. The main aims of mechatronics educational program at Assiut University are to:

- Equip the students with multidisciplinary capabilities to design mechatronic systems by integrating mechanical, electronics and information technology.
- Prepare qualified students who can design, and supervise the process of designing at each level, use and apply latest manufacturing techniques to improve products quality and enhancing the system performance.
- Prepare future multidisciplinary engineers to meet the demands for a flexible engineering workforce equipped with information technology, embedded systems and precision mechanical systems to deal with computer integrated manufacturing systems, maintenance, diagnosis and troubleshooting, defense systems, robotics, micro-electromechanical systems and vehicles manufacturing.
- Meet the industrial demand for mechatronic engineers who are needed nowadays more than ever.
- Fill the gap between mechanical and electronic engineering programs.

### 3.2. Academic Standard for Mechatronics Engineering

In addition to the general attributes of the engineer, The graduates of Mechatronics programs must be able to demonstrate.

#### 3.2.1 Knowledge and Understanding:

On successful completion of the programmes graduates must be able to demonstrate knowledge and understanding of:



- a) Basic science and engineering fundamentals;
- b) Fundamentals of problem identification, formulation and solution in the areas of Mechatronics;
- c) The approach to design and operational performance;
- d) Social, cultural, global and environmental responsibilities of the professional engineering, and the need for sustainable development;
- e) The principles of sustainable design and development;
- f) Professional and ethical responsibilities and commitment to them.

### **3.2.2 Intellectual Skills**

On successful completion of this programme graduate must be able to:

- a) Apply knowledge of basic science and engineering fundamentals;
- b) Undertake problem identification, formulation and solution;
- c) Utilize a systems approach to design, analysis and development and practical investigations;
- d) Apply the principles of sustainable design and development;
- e) Full awareness of the needs to undertake lifelong learning, and capacity to do so.

### **3.2.3 Professional & Practical Skills**

On successful completion of the programmes, students must be able to:

- a) Compete, in-depth, in at least one engineering discipline;
- b) Manage field problem, identification, formulation and solution;
- c) Utilize practical systems approach to design and performance evaluation;
- d) Apply the principles of sustainable design and development

## **3.3. Intended Learning Outcomes (ILOs)**

### **a- Knowledge and Understanding:**

- a1- Understanding the theory and fundamentals of basic science and engineering subjects.
- a2- Understanding of the basic of information technology
- a3- Understanding of the theory and fundamentals of basic mechanical engineering subjects.
- a4- Understanding of the basics of applied mechanical engineering subjects.
- a5- Familiarize the students with the role of computer software in engineering systems.
- a6- Understanding of the basic and advanced control theory.
- a7- Understanding the basics of electronics and computer interface.

- a8- Some knowledge and understanding of management techniques.
- a9- Understanding of the concept and philosophy of Mechatronics.
- a10- Understanding of the concept and philosophy of Robotics

**b- Intellectual Skills**

- b1- Capability of mathematical modeling of physical systems.
- b2- Ability to design and simulate mechatronic components and systems .
- b2-Ability to identify, analyze, model and simulate problems related to Mechatronic applications.
- b3- Ability to design experiments for testing components and systems and analyzing experimental data to evaluate system performance or for fault diagnosis, or to gain new data.
- b4- Ability to identify problems and drawbacks in tested components/ system and recommendations for design enhancement or proper selection of components.
- b5- Ability to solve engineering problems based on limited information.

**c-Professional Skills**

- c1- Ability to use software packages to simulate Mechatronic systems.
- c2- Ability to design Mechatronics components and systems.
- c3- Ability to find optimal and reliable solutions of engineering problems.
- c4- Capabilty of applying computer aided engineering techniques (CAE).
- c5- Ability to integrate, operate and test practical mechatronic systems.
- c6- Use of wide range of tools, techniques and equipment including software.
- c7- Use laboratory and workshop equipment to generate valuable data.
- c8- Develop, promote and apply safe systems of work.

**d- General Skills**

- d1- Ability to communicate with others.
- d2- Ability to work in a team.
- d3- Ability to present data and results and writing up technical reports.
- d4- Active listening and understanding to others.
- d5- Active involvement in group discussions.
- d6- Ability to search for information's from references, journals and internet.
- d7- Use I T effectively.
- d8- Self education applying e- learning and web based educational prograames.
- d9- Foriegn language (English) abilities( spoken and written).

**Academic standards for Power Mechanics Eng. program****4****4-1- Program Aims**

Program of mechanical power engineering aims to

- provide the information necessary to develop a professional mechanical power engineer at an acceptable level.
- Involve basic and applied sciences and technologies adopted to design, production , performance and maintenance of equipment and machinery required for the profession of mechanical power engineer.
- provide the acquired knowledge necessary to tackle problems related to power generation and, energy conversion and management and problems of multi-disciplinary engineering.
- provide program graduates with abilities to analyze and interpret data to solve problems, finding alternatives, and appreciate economic-based decision making.
- provide graduate engineers with intellectual, analytical and experimental skills and promote critical thinking and judgment.
- involve the necessary knowledge and understanding of business and management skills, quality assurance, and environment protection needed for mechanical power engineer professional practice .
- assure values, ethics, and societal responsibilities in engineering professional practices.
- equip graduates with technical, personal, communication and group leading skills needed to pursue professional practices.
- provide program graduates with skills to obtain data from various sources including information and communication technology (ICT) that enable them enhance their knowledge and deal with new advancing technologies.

**4-2 Academic Reference Standards For Mechanical Power Engineers**

- The following academic reference standards represent the general expectations about the qualifications attributes capabilities that the graduates of mechanical power programs should be able to demonstrate.
- **3.3.1 Knowledge and Understanding:**
  - On successful completion of the programme graduates must be able to demonstrate knowledge and understanding of:
    - a) Essential facts, fundamentals, concepts, principles and theories relevant to Mechanical Engineering;

- b) The constraints which mechanical power and energy engineers have to judge to reach at an optimum solution.
- c) Concepts and theories of basic sciences, mathematics and the technological base relevant to Mechanical Power and Energy Engineering.
- d) Business and management techniques and practices appropriate to mechanical power and energy engineering applications.
- e) The professional and ethical responsibilities of mechanical power and energy engineers.
- f) The impact of mechanical power and energy engineering solutions in a global and societal context.
- g) Mechanical power and energy engineering contemporary issues.
- h) Relevant mathematical and numerical methods and the principles of engineering and mechanical engineering sciences as applied to mechanical power and energy engineering systems.
- i) The basic theories and principles of some other engineering and mechanical engineering disciplines providing support to mechanical power and energy disciplines.
- j) The role of information technology in providing support for mechanical power and energy engineers.
- k) Engineering design principles and techniques and their applications to mechanical power and energy engineering.
- l) Characteristics and properties of materials relevant to mechanical engineering applications.

#### – **3.3.2 Intellectual Skills**

- On successful completion of this programme student must be able to:
- a) Solve engineering problems and design mechanical power and energy systems, components and elements in a creative and innovative attitude.
- b) Apply the appropriate tools from mathematics, science, technology, and the know-how gained from the professional experience to analyze mechanical engineering design problems to meet certain needs.
- c) Solve mechanical engineering problems, often on the basis of limited and possibly contradictory information.
- d) Analyze and interpret data, and design experiments to obtain new data.
- e) Evaluate mechanical power and energy engineering designs, processes and performances and propose improvements.
- f) Maintain a sound theoretical approach in dealing with new and advancing technology.

- g) Assess risks, and consider appropriate steps to manage them.
- h) Use the principles of engineering sciences in developing solutions to practical mechanical engineering problems.
- i) Create new engineering components and processes through the synthesis of ideas from a range of sources.
- j) Analyze the results of numerical models and acknowledge their limitations.

### – **3.3.3 Professional & Practical Skills**

- On successful completion of the programmes, graduates must be able to:
- a) Use a wide range of analytical and technical tools, techniques and equipment including pertinent software.
- b) Use basic workshop equipment safely and appropriately.
- c) Analyze experimental results and determine their accuracy and validity.
- d) Prepare engineering drawings, computer graphics and specialized technical reports.
- e) Refer to scientific literature effectively.
- f) Use computational tools and packages and write computer programs pertaining to mechanical power and energy engineering.
- g) Apply numerical modeling methods and/or appropriate computational techniques to engineering problems.
- h) use appropriate computer software and laboratory equipment.
- i) Search for information.
- j) Demonstrate basic organizational and project management skills.
- k) Carryout specialized engineering design.
- l) Work in mechanical power and energy operations, maintenance and overhaul

## **4-3- Intended Learning Outcomes (ILOs)**

### **a- Knowledge and Understanding: (K & U).**

Engineering graduates students should demonstrate knowledge and understanding:

- a1- covering necessary topics of science, mathematics, computers and models needed to serve engineering topics such as heat transfer, fluid mechanics, mechanical vibration and automatic control.
- a2- covering essential concepts, principals and theories relevant to mechanical power engineering such as fundamentals of stress analyses , machine design, production, mechanics, thermodynamics, fluid mechanics, heat transfer, gas dynamics and combustion.
- a3- covering design as well as problem solving techniques, methods and maintenance in areas related to applied mechanical power engineering such as power plants,

refrigeration and air conditioning, internal combustion engines, hydraulic machines and turbo-machinery .

- a4 – covering some of business and management topics required for the profession of engineering in the future as well as economical assessment techniques.
- a5- covering topics of environmental engineering that concern with the impact of power engineering industries and processes on the environment and society including proper techniques of pollution control and pollutant emission reduction.
- a6- covering topics of renewable and alternative energy sources necessary to meet the challenge of deficiency of conventional energy sources and their unacceptable environmental impact .

### **b- Intellectual Skills (IS)**

Graduating engineers have to be creative and innovative and should be able to:

- b1- solve engineering problems within the given information and constraints in a wide area of specialty such as internal combustion engines, power plants, air conditioning, refrigeration plants and public services etc.
- b2- analyze and interpret data or design experiments to gain required data for performance evaluation and fault diagnoses of mechanical power equipment such as pumps, steam/gas turbines hydraulic and turbo-machinery , power plant units and equipment, internal combustion engines etc.
- b3- design component, system or process to meet certain need (repair or development of an existing mechanical power equipment or plants/workshops ) or select appropriate spare parts from manufacturer catalogues.
- b4- evaluate systems, processes, and equipment performance technically as well as the from economic point of view.
- b5- introduce new and advancing technology to improve the performance of existing or old technology in areas such as power generation, air conditioning, energy conservation, ..etc.
- b6- realize balancing between costs, benefits, quality and reliability in case of producing new products/technology as well as improving existing equipment or plant.
- b7- assess risks and safety precautions covering all working machinery, pressure vessels, toxic and flammable fluids, ....and take appropriate measures to manage them.

### **c- Professional and Practical Skills (PS)**

Graduating engineers have to demonstrate mechanical power practical skills particularly concerning laboratory, workshop machines, and use of some specific software. They should be able to:

- c1- use a wide range of tools, instruments, techniques and equipment in the area of specialty ( for measuring thermo-fluid properties, mechanical properties, performance ..etc).

- c2- use laboratory and workshop equipment to generate valuable data concerning the performance of different equipment related to power generation and energy conversion such as boilers, steam turbine, refrigeration cycles .... etc.
- c3- develop, promote and apply safe systems of work following the proper instructions and codes.
- c4- make layout of power plants, refrigeration plants and air conditioning systems.

**d- General Skills (GS)**

Graduating engineers should have transferable skills and will be life enriching. These skills include ability to:

- d1- communicate effectively with colleagues, labour senior staff and other personnel using oral and written methods.
- d2- use ITC effectively
- d3- manage resources and time
- d4- work in multi-disciplinary team
- d5- undertake lifelong learning, particularly for continuing professional development.
- d6- develop creativity, particularly in design and performance of equipment or processes
- d7- develop in mind certain qualities needed for graduate to define, analyze and solve problems.
- d8- be innovative in the solution of engineering problems and the adoption of new technology.
- d9- be self –motivated in the pursuit of their studies and professional practice.
- 1- d10- be enthusiastic in the application of their skills, in the pursuit of the practice of engineering and the promotion of work discipline.

## Academic standards for mechanical design and production Eng. program 5

### Professional Information

#### 5-1 Program Aims

Provide the future engineer with knowledge, skills, attitude, values and responsiveness to technical needs in the following branches:

- **Fundamental courses to understand the machine design such as: machine construction, stress analysis and material science.**
- Understand the principles of manufacturing processes such as production technology, metal cutting and metal forming.
- Studying the different methods for measuring of engineering quantities and basic principles of machine vibration and automatic control.
- Application of new methods in production engineering.
- CAD & CAM applications.
- Application of advanced methods to quality control, operation research, time and motion study of manufacturing process and factory planning.
- Project management and marketing.

#### 5-2 Academic Reference Standards for the program

The following academic reference standards represent the general expectation about the qualifications attributes and capabilities that the graduates of Mechanical design and production engineering programs should be able to demonstrate.

##### 5-2-1 Knowledge and Understanding:

On successful completion of the programmes graduates must be able to demonstrate knowledge and understanding of:

- a) Concepts, principles and theories relevant to Mechanical Engineering and manufacture;
- b) Science, mathematics and the technological base relevant to Mechanical Engineering;
- c) The constraints within which his/her engineering judgment will have to be exercised;
- d) The specifications, programming and range of application of CAD and CAD/CAM facilities
- e) Relevant contemporary issues in mechanical engineering.



- f) Basic electrical, control and computer engineering subjects related to the discipline
- g) The role of information technology in providing support for mechanical engineers
- h) Engineering design principles and techniques.
- i) Characteristics of engineering materials
- j) Management and business techniques and practices appropriate to engineering industry.

### **5-2-2 Intellectual Skills**

On successful completion of this program graduate must be able to:

- a) Adopt creative and innovative thinking in solving problems, and in designing products, systems, components and processes;
- b) Apply the principles of mathematics, science and technology in problem solving scenarios in mechanical engineering;
- c) Analyze and interpret data, and design experiments to obtain primary data;
- d) Design systems, components or processes to meet specific needs;
- e) Evaluate and appraise designs, processes and products, and propose improvements;
- f) Assess risks, and take appropriate steps to manage those risks.
- g) Interpret numerical data and apply analytical methods for engineering design purposes
- h) Use the principles of engineering science in developing solutions to practical mechanical engineering problems.
- i) Solve mechanical and product design in engineering problems.
- j) Create new engineering components and processes through the synthesis of ideas from a range of sources.
- k) Use computational tools and software packages pertaining to the discipline and develop required computer programs;

### **5-2-3 Professional & Practical Skills**

On successful completion of the programs, students must be able to:

- a) Use a wide range of analytical and technical tools, techniques and equipment, including pertinent software;
- b) Prepare engineering drawings, computer graphics and specialized technical reports and communicate accordingly.
- c) Carry out specialized engineering designs.
- d) Employ the traditional and modern CAD and CAD/CAM facilities in design and production processes
- e) Use basic workshop equipment safely;
- f) Understand and apply safe systems at work;
- g) Analyze experimental results and determine their accuracy and validity;
- h) Use laboratory equipment and related computer software;

- i) Demonstrate basic organizational and project management skills.
- j) Operate and maintain mechanical equipment.
- k) Refer to relevant literature effectively

### **5-3-Intended Learning Outcomes (ILOs)**

#### **a- Knowledge and Understanding:**

- a1-Principals of machine elements and stress analysis.
- a2-Mechanical properties of materials and methods of testing.
- a3-Types of mechanisms and theory of machines.
- a4- Theory of metal cutting and machine tool design.
- a5- heat transfer and thermodynamics and their applications in casting process.
- a6- Theory of metal forming and its application.

#### **b- Intellectual Skills**

- b1-Ability to construct mathematical models of machine components
- b2- Skill of using computer for solving the mechanical problems and machine performance monitoring.
- b3-Skill of modeling and simulation of machine structure.
- b4- Skill of new methods for production planning (group technology)
- b5- Choosing the optimum layout and production stations.

#### **c-Professional Skills**

- c1-Optimum design of different machine elements
- c2- Selecting optimum methods of production.
- c3- Knowledge of new developed measuring and control devices.
- c4- Developing the sense of solving different mechanical engineering problems.
- c5- The ability of test and repair machines.

#### **d- General Skills**

- d1-Ability to think about the solution of mechanical engineering problems.
- d2- Ability to interpret the result
- d3-Ability to suggest alternatives to solve the related problems in the field.
- d4- Ability to think and manipulate industrial problems.
- d5- Ability to select the suitable devices and suitable experimental methods.

**Academic standards for computer and systems Eng. program****6****6.1 Introduction:**

Computer engineering (CE) is a discipline that embodies the science and technology of design, construction, implementation, and maintenance of software and hardware components of modern computing systems and computer-controlled equipment.

Computer engineering has traditionally been viewed as a combination of both computer science (CS) and electrical engineering (EE). Computer engineering is a field that experiences effects from rapid technological development in different real life applications. Computer engineering programs use basic mathematics, sciences, engineering and electronics, physical and human sciences to provide new computer technologies and systems that make human applications easier, more productive, faster and also enjoyable to use.

A computer engineer is a person trained to be proficient in the design and implementation of computer systems, both hardware and software. Essentially, one must be able to design digital control circuitry and program it to function in the proper manner. To perform these tasks, one must usually be knowledgeable and capable in mathematics and sciences. However, pure theory is not enough to make a person a good computer engineer. Real world experience through practice of engineering concepts is also very important and can distinguish between a computer engineer and another.

Computer engineer must possess a considerable knowledge of mathematics. He must also possess knowledge of physics and other experimental sciences, general engineering and the systems that are employed in the field of computer engineering in order to be able to operate those systems. An obvious knowledge requirement for the computer engineer is knowledge of computers and electronics, since a computer engineer must understand how electronics and computers work in order to perform their job in a proper manner.

Computer engineer should be capable of permanently providing the society with every state-of-the-art developments in computer technologies and their applications to real life systems through life-long learning.

### **Computer Engineer may work in:**

Private and governmental firms and agencies, where it is required to design, manufacture, operate, develop or maintain computer systems or computer-controlled systems. He/She may also work as a computer network engineer.

## **6.2 THE ATTRIBUTES OF A COMPUTER ENGINEER**

Computer engineering is a field that requires many skills. In addition to the general attributes of an engineer, the computer engineer must be able to:

- Apply knowledge of computing, mathematics, physics and logical skills appropriate to the computer engineering discipline;
- Analyze a problem, and identify and define the computing requirements appropriate to its solution;
- Design, implement and evaluate a computer-based system, process, component, or program to meet desired needs;
- Use general computer and software tools professionally;
- Analyze operations, realize requirements and constraints of projects and, consequently, achieve an appropriate cost effective design.
- Perform troubleshooting in computer systems.
- Exhibit competency in English as a second language as suitable for the discipline
- Demonstrate inductive reasoning abilities, figuring general rules and conclusions about seemingly unrelated events
- Analyze the local and global impact of computing on individuals, organizations and society;
- Use current advanced techniques, skills, and tools necessary for computing practices.
- Design and analyze embedded systems>
- Deal with the computer hardware, software, operating systems and interfacing.
- Realize control theory and measurement systems for industrial variables, signal conversion, conditioning and processing.
- Provide innovative solutions for different control and computer problems.

## **6.3 ACADEMIC STANDARDS FOR Computer and Systems ENGINEERING**

### **a) Knowledge and Understanding:**

- 1) Essential facts, concepts, principles and theories relevant to computer and systems engineering;

- 2) Basic science, mathematics, and technologies relevant to computers and control systems.
- 3) Relevant mathematical methods, physical laws and the principles of electronic engineering science as applied to computer engineering systems;
- 4) Engineering principles in the fields of logic design, circuit analysis, machine and assembly languages, computer organization and architectures, memory hierarchy, advanced computer architectures, embedded systems, signal processing, operating systems, real-time systems and reliability analysis.
- 5) The components and materials used by computers and systems engineers.
- 6) Quality assessment of computer systems;
- 7) Principles of design specific to computer and systems engineering;
- 8) A range of programming languages and environments;
- 9) Broad general education necessary to understand the impact of computer engineering solutions in a global and societal context;
- 10) Microprocessors and computer architectures
- 11) Operating systems: design/administration
- 12) Related research methods and approaches to create more advanced products.
- 13) Basics of design and analyzing electronic engineering systems, while considering the constraints of applying inappropriate technology and the needs of commercial risk evaluation;
- 14) Analyzing and design of control systems with performance evaluation;
- 15) Safety practices as they apply to the field of control and computer engineering.

**b) Intellectual Skills**

- 1) Plan, conduct and construct computer networks and automatic control systems.
- 2) Analyze and evaluate computer and control systems and consider possible improvements.
- 3) Write software program and/or design hardware system to meet certain demand.
- 4) Show creativeness in the solution of problems and in the development of designs.
- 5) Assess the mathematical tools/models for the solution of problems in computers and systems.

- 6) Determine the proper model to use in the analysis of analog and digital systems.
- 7) Adopt suitable theoretical and computer-based techniques to use for the analysis of computer and system engineering problems.
- 8) Select and apply appropriate IT tools to a variety of computer and control engineering problems.
- 9) Select and apply appropriate scientific principles, mathematical and computer based methods for analyzing general computer and control systems.
- 10) Organize tasks into a structured form.
- 11) Understand the evolving state of knowledge in a rapidly developing area.
- 12) Transfer appropriate knowledge and methods from one topic to another.
- 13) Plan, conduct and write a report on a project or assignment.
- 14) Prepare an oral presentation.
- 15) Analyze and evaluate modern computer and control systems and consider possible improvements.

**c) Practical Skills**

- 1) Effectively uses computers to conduct tests and construct systems.
- 2) Use laboratory and workshop equipments effectively to generate valuable data and monitor the performance of various systems, using appropriate measurement techniques.
- 3) Analyze experimental or computational results and determine their strength and validity.
- 4) Troubleshoot, maintain and repair computer and control systems using the standard tools.
- 5) Use appropriate analysis and design tools.
- 6) Explain appropriate specifications for required devices.
- 7) Use appropriate tools to measure system performance. execute safely a series of electronic circuits and computer based tests and experiments
- 8) Use computational tools and software packages.
- 9) Apply appropriate mathematical tools for the solution of problems in computers and systems.
- 10) Apply the correct models to use in the analysis of hardware systems.
- 11) Apply project management techniques to the organization of small projects.
- 12) Write efficient computer programs.
- 13) Present work both in written and oral form
- 14) Balance between cost and performance of control and computer systems.

- 15) Integrate technical professionalism and societal and ethical responsibility.

**d) General Skills**

- 1) Communicate effectively with colleagues and others, using both written and oral methods.
- 2) Give oral presentations using a variety of visual aids.
- 3) Be able to retrieve information and organize data.
- 4) Work effectively as a member in a multi-disciplinary team.
- 5) Use information and communications technologies effectively.
- 6) Manage resources and time.
- 7) Learn independently and effectively in familiar and unfamiliar situations with open mindedness.
- 8) Develop creativity, particularly in design and performance of computer and control systems
- 9) Learn effectively for continuing professional development and in a wider context throughout his career.
- 10) Collect data, draw, (block diagram, charts, and curves) and interpret data.
- 11) Be enthusiastic in the application of their skills in the pursuit of the practice of engineering and promotion of the discipline.

**Academic standards for Communication Eng. program****7****Introduction:**

Electronics and communications are becoming more and more influential on the human society. Electronic and communication products are utilized in almost all aspects of our life and are hence produced in huge quantities.

Nowadays, electronic and communication subsystems have become a vital part of almost any industrial product. To cover the broad spectrum of applications and the technically demanding problems, the Electronic and Communication Engineering program covers the basic laws of physical sciences, mathematics, traditional computer science and basic engineering sciences. It also combines the principles of electronic and communication engineering with good practice in design and project management.

In this way, graduates will be well qualified to play a disciplined and innovative part in research and development across the Electronics, Communications and Information Technology sectors.

An Electronics and Communications engineer should have strong background in basic sciences and basic mathematics and be able to use these tools in their own engineering field. He should employ necessary techniques, hardware, and communication tools for modern engineering applications. Also, he should be able to work in a multi-disciplinary environment, and follow and contribute to the developments in their own field recognizing the significance of lifelong learning.

Electronics and communications engineering is a broad discipline that covers the fields of integrated electronic circuits, electronic data storage, high-speed computing, wired and wireless communications, signal processing, microwaves, wave propagation and antennas, optoelectronics, automation, automatic control and monitoring systems, circuit analysis, network analysis, digital signal processing, microprocessors, multimedia systems, digital communications, information theory, and communication Networks.

The programs of electronics and communications engineering are designed to strike (achieve) a balance between theoretical (analytical) and laboratory experience and to impart fundamental and practical understanding of the principles required for a successful career in electronics and communications engineering. This requires a solid core of foundation courses in physics, mathematics, computer science, and general engineering, which is also essential for lifelong learning. Concentration courses in Electronics Engineering (that integrate theory and laboratory wherever possible) cover electromagnetics, wave propagation and antennas, circuits, electronics, power electronic devices, digital logic design, computers, programming, computer networks, signal processing, optoelectronics and wired and wireless communications. Courses of interest are electric machinery, power system, classical control, modern control, industrial electronics circuits, digital control techniques, robotics, mechatronics, biomedical systems and



modern automation systems. The capstone senior thesis and industrial internship are also required. State-of the-art electronics and communications engineering elective courses provide seniors and advanced undergraduates in the recent industrial electronics and communications.

Graduates who followed one of electronics and communications engineering programs are careered into jobs including manufacturers of mobile phones, telephone centrals, computers, antenna and radar systems, industrial control, home appliances, biomedical engineering, networking companies, communication systems, and integrated circuits. Others have joined research groups in university, and industry, the public service, and the teaching professions.

## **7.1 THE ATTRIBUTES OF AN ELECTRONICS AND COMMUNICATIONS ENGINEER**

In addition to the general attributes of engineer, the electronics and communications engineer must be able to:

- 1) Apply advanced science (such as physics and mathematics....) and engineering principles to electronics and communications systems.
- 2) Be able to communicate effectively, both orally and in writing.
- 3) Have the ability to design and execute an individual project.
- 4) Be able to understand environmental, economic and community impacts on development.
- 5) Have the relevant mathematical and computational skills.
- 6) Participate in and lead quality improvement projects.
- 7) Know the technology required to design, build, operate and maintain electronic and communication systems, analog or/and digital, and all types of computers.
- 8) 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.
- 9) Realize control theory and measurement systems for industrial variables, signal conversion, conditioning and processing.
- 10) Deal with the computer hardware, software, operating systems and interfacing.
- 11) Know the field of digital and analog communications, mobile communications, coding, and decoding.
- 12) Familiarize her/him-self with the nano-technology that will invade the electronics world in the future.
- 13) Be able to understand communication systems, signal processing, and optoelectronics.
- 14) Gain key practical skills and competence.
- 15) To address the issues of environmental problems concerning noise, safety,.... and proposes the corresponding solutions.
- 16) To enter employment industry, the professions or public service, or to follow a postgraduate route into research, industry or academia, or apply the skills learnt in areas other than electric engineering,
- 17) To learn how to get access to information required in his profession: through books, professional magazines, internet...etc.

## **7.2 ACADEMIC STANDARDS FOR ELECTRONICS AND COMMUNICATIONS ENGINEERING**

### **7.2.1 Knowledge and Understanding:**

On successful completion of the programs, graduates must be able to demonstrate knowledge and understanding of:

- a1) Basics of mathematical techniques to help model and analyze systems, and use mathematics as a tool for communicating results and concepts;
- a2) Elementary science underlying electronic and communication engineering systems and information technology;
- a3) Basics of design and analyzing electronic engineering systems, while considering the constraints of applying inappropriate technology and the needs of commercial risk evaluation;
- a4) Managing and practicing business, including finance, law, marketing and quality control;
- a5) The professional and ethical responsibilities of engineer
- a6) Analyzing and design of electronic circuits and components;
- a7) Analyzing and design of control systems with performance evaluation;
- a8) Biomedical instrumentation;
- a9) A range of programming languages and environments;
- a10) Communication systems
- a11) Coding and decoding techniques
- a12) Microwaves applications
- a13) Antennas and wave propagation
- a14) Nanotechnology applications
- a15) Usage of optical fiber
- a16) Methods of fabrication of Integrated circuits
- a17) Analysis of signal and system
- a18) Optical communication systems
- a19) According to the desire of students, (they can select) elective courses covering advances in microwaves, electronics, biomedical and (advanced) communication engineering.
- a20) The components and materials used by electronic devices and communication systems
- a21) Safe working practices as they apply to the field of microwaves, electronic and communication systems engineering.

### **7.2.2 Intellectual Skills**

On Successful completion of the programmers, graduates must be able to:

- b1) Select and apply appropriate scientific principles, mathematical and computer based methods for analyzing general electronic engineering systems.
- b2) Initiate creative thinking for resolving and developing innovative solutions for the practical industrial problems.
- b3) Organize tasks into a structured form.
- b4) Understand the evolving state of knowledge in a rapidly developing area.
- b5) Transfer appropriate knowledge and methods from one topic to another.
- b6) Plan, conduct and write a report on a project or assignment.
- b7) Prepare an oral presentation.

- b8) Approach the suitable tools for solving problems to tackle any practical problems in the electronics and communications field.
- b9) Analyze, interpret, and explain data and design experiments to obtain new data
- b10) Develop computer programs.
- b11) Select and apply appropriate IT tools to a variety (variety) of engineering problems.
- b12) Apply the correct model to be used in the analysis of electronic circuits and devices.
- b13) Plan, conduct and construct electronic circuits, communication and computer networks.
- b14) Analyze and evaluate modern communication systems and consider possible improvements.
- b15) Assessing the mathematical tools/models for the solution of problems in electronics, communication systems and computer engineering.

### **7.2.3 Practical Skills**

On Successful completion of the programmers, graduates must be able to:

- c1) Use appropriate mathematical methods or IT tools.
- c2) Program a computer to solve problems.
- c3) Use relevant laboratory equipment and analyze the results correctly.
- c4) Troubleshoot, maintain and repair almost all types of electronic systems using the standard tools.
- c5) Synthesis and integrate electronic systems for certain specific function using the right equipment.
- c6) Design, build and test a system.
- c7) Use appropriate analysis and design tools.
- c8) Explain appropriate specifications for required devices.
- c9) Use appropriate tools to measure system performance. execute safely a series of electronic circuits and computer based tests and experiments
- c10) Program a computer to solve problems.
- c11) Utilize project management methods.
- c12) Present work both in written and oral form
- c13) Analyze experimental or computational results and determine their strength and validity.
- c14) Balance between cost and performance of electronics and communication systems.

### **7.2.4 General Skills**

Graduated engineers should have transferable skills and life enriching. These skills include the ability to:

- d1) Communicate effectively with colleagues and others, using both written and oral methods.
- d2) Give oral presentations using a variety of visual (Multimedia) aids.
- d3) Retrieve information and organize data.
- d4) Work effectively as a member in a multi-disciplinary team.
- d5) Use information technologies effectively.

- d6) Develop creativity, particularly in design and performance of equipment and circuits
- d7) (Efficiently) manage resources and time.
- d8) Learn independently in familiar and unfamiliar situations with open mindedness.
- d9) Learn effectively for continuing professional development and in a wider context throughout his career.
- d10) Collect data, draw, (block diagram, charts, and curves) and interpret data.
- d11) Be enthusiastic in the application of their skills in the pursuit of the practice of engineering and promotion of the discipline.

**Academic standards for Elect. Power Eng. program****8**

Electrical power and machines engineering discipline is that main branch of electrical engineering which concerns with generation, transmission, distribution, utilization, protection and control of electric energy. The vast electrical power systems which expand over each nation in the world and interconnection networks among neighboring countries are considered the largest and most complex man-made systems. Proper planning, design, implementation, operation and control of these large-scale electrical power systems require advanced engineering knowledge and techniques. Electrical generators, electric motors and transformers constitute the main components of any electrical network where modern power electronics and automatic control techniques are extensively employed in electrical power and machines systems for improving performance, operation and control.

The two main field subjects of the electrical power and machines engineering program are namely electrical power engineering and electrical machines engineering. Automatic control engineering and power electronics are main topics supported the program. Other essential subjects in the program include electrical circuits, electronic circuits and devices, electromagnetism, energy conversion, measurements and computer programming. Basic subjects in the program include mathematics, physics, materials engineering, workshop technology and laboratories.

The electric power and machines engineering program should be characterized by the following properties:

- To provide students with a wide and comprehensive introduction to basic sciences and mathematics in addition to basic engineering skills such as drawings, workshop technologies, laboratories and practical field training.
- To provide with the required depth in electrical power and machines engineering subjects necessary for performing engineering jobs as well as for future postgraduate studies and research in the field of electrical engineering.
- To provide students with principals of engineering design skills and necessary environment to work both individually and within groups.

Thus, the general educational objectives of the electrical power and machines engineering program lie in produce engineers that has:

- Basic Knowledge in different electrical engineering especially in the fields of electrical power engineering: fundamentals of electrical engineering, electrical machines, electric power systems, high voltage engineering, power electronics, protection and switchgear engineering, analysis, planning, operation control of power systems, electrical measurements and testing.
- Practical skills in the field of electrical power engineering.
- Ability to define, analyze and solve electrical power engineering problems to reach proper conclusions and to communicate these conclusions with others.
- Ability to contribute effectively to the advancement of electrical engineering profession and to accommodate the needs of local and global industries.

However, the objectives may be extended to some specific educational objectives which aim at preparing the graduate engineers to:

- Becoming life long learners, innovators and are able to shape the social, intellectual, business and technical activities.
- Insure that they understand the necessities for professionalism, ethical responsibilities and the needs to function in multidisciplinary teams.
- Prepare them for engineering analyses and problem solving using appropriate mathematical and computational methodologies as well as to use experimental and data analysis techniques electrical power and machines engineering applications.
- Express themselves effectively in both oral and written communication.
- Provide them with awareness of tools and skills necessary for participating effectively in building a strong national economy and to meet current and future modern industry needs.

### **8.1 The Attributes of Electrical Engineers**

- a) Solid foundation in mathematics and physics.
- b) Good logical and mental ability and problem solving skills.
- c) Ability to plan, design, manage engineering activity and supervise the construction of different parts of electric power network.
- d) Ability to assess the impact of engineering work on society, the economy and the environment.

- e) Work effectively as individual and as a member of a team as well as with persons from other disciplines.
- f) Act professionally and ethically.

## **8.2 Academic Standards for Electrical Power Engineers**

### **5a- Knowledge and Understanding:**

Electrical power and machines engineering graduates should have the following

#### **8.2.1 Knowledge and understanding:**

- a1- Appropriate principles of mathematical methods and science relevant to electrical components and systems.
- a2- Fundamental concepts, principles and theories of basic engineering courses as well as sciences (physics and chemical engineering) relevant to electrical engineering.
- a3- Characteristics and control of the electrical machines and power systems under given condition of works.
- a4- Principals and techniques of design and tools specific to particular processes.
- a5- Principles of safe operation and /or responsibilities for social context of engineering.
- a6- Analytical and computer methods appropriate for electrical power and machine engineering.
- a7- Fundamentals of engineering management and ethical responsibilities of electrical engineer.
- a8- Managing and practicing business, including finance, law, marketing and quality control.
- a9- According to the desire of students, elective courses covering advances in electrical power and electrical machine engineering.
- a10- Electric and electronic circuits engineering.
- a11- Electrical measurements measuring instruments.
- a12- Electrostatic and electromagnetic fields and their interactions.
- a13- High voltage engineering and insulation characteristics.
- a14- Automatic control engineering and concepts of designing of automatic control systems..
- a15- Different energy conversion methods and technologies.
- a16- Theories of construction, operation, control, and design of electrical machines.

- a17- Engineering of electric power systems (generation, transmission and distribution systems)
- a18- Economic operation, planning, and design of electric power systems.
- a19- Power system characteristics in steady state, and transients.
- a20- Building electrical testing systems.
- a21- power system protection and design of protection schemes.

### **8.2.2 Intellectual Skills:**

Electrical power and machines engineering graduates should be able to:

- b1- Ability to select and apply mathematical methods for modeling and analyzing engineering and / or electrical engineering problems.
- b2- Use of the scientific principles in development of engineering and/or electrical engineering solutions to practical problems.
- b3- Obtaining an acceptable operation under abnormal conditions and solve field problems.
- b4- Analysis and modeling power systems and/or electrical machines to give required operation.
- b5- Understanding the ability to undertake technical risk design and evaluation.
- b6- Apply professional judgment on wrong field operation.
- b7- Ability to define the general engineering problems and in particular in electrical engineering.
- b8- Ability to derive different alternative solutions for the electrical engineering problems.
- b9- Ability to analyze the solution alternatives and select the optimum one.
- b10- Ability to identify acceptable solutions of problems based on physical and operational of power systems.
- b11- Ability to correlate between a solutions based on a given system state to the system behavior at different states

### **8.2.3 Professional and Practical Skills:**

Electrical power and machines engineering graduates should be able to:

- c1- Design and perform experiments as well as analyze and interpret experimental results related to electrical power and machines systems.



- c2- Test and examine components, equipment and systems of electrical power and machines.
- c3- Integrate electrical, electronic and mechanical components and equipment with transducers, actuators and controllers in creatively computer controlled systems.
- c4- Specify and evaluate manufacturing of components and equipment related to electrical power and machines.
- c5- Apply modern techniques, skills and engineering tools to electrical power and machines engineering systems.
- c6- Use of appropriate mathematical methods for solution specific engineering and/or electrical power and machine engineering problems.
- c7- Use of the scientific evidence based methods in the solution of electrical power and machine problems.
- c8- Use of information technology (IT) software effectively as well as apply modern techniques, skills and engineering tools to electrical power and machines engineering systems.
- c9- Use of workshop, laboratory and measurement equipment to generate valuable data.
- c10- Development, promotion and application safe systems of work.
- c11- Manipulation and sorting of data and presentation of it in a variety of ways.
- c12- Management resources and time.
- c13- Effectively communicate with colleagues and others using written and/ or oral methods.
- c14- balance between cost and performance of electric power systems.

#### **8.2.4 General and transferable Skills:**

Electrical power and machines engineering graduates should be able to:

- d1- Manage tasks and resources.
- d2- Work effectively as a member in a multi-disciplinary team.
- d3- Ability to share ideas and communicate efficiently with others.
- d4- Ability to deal with others according to the rules of professional ethics.

- d5- Work in stressful environment and within constraints.
- d6- Demonstrate efficient IT capabilities.
- d7- Lead and motivate individuals.
- d8- Search for information and adopt life-long self learning.
- d9- Acquire entrepreneurial skills.
- d10- Ability to effectively present technical information in both written and spoken forms.
- d11-Learning ability needed to undertake appropriate further training of a professional nature.

## Academic standards for Civil Eng. program

9

**Proposed updated program for Civil Engineering could be summarized as follows:**

### 9.1 Professional Information

#### - Program Aims

- To provide the necessary courses for graduating a professional civil engineer that provides the community with a wide range of civil works and structures for better and easier living conditions.
- To involve science and technology adopted to act professionally in design and supervise construction of all sorts of buildings, bridges, harbors and airports, design, construct and protect all types of excavations and tunneling systems. In addition to select, plan, and design roadways that provide suitable, safe, secure and economic traffic means. Provide the suitable water resource for communities and make the adequate design of water and sewerage networks and public works' installations that are required for the development, welfare and independence of the society. Select and design adequate water control structures, irrigation and water networks and pumping stations.
- To graduate a civil engineer with the acquired knowledge to tackle problems of multi-disciplinary engineering, Plan, design, construct, operate, control and carry out maintenance of all types of civil Engineering structures. Design and construct structures for protection against dangers of unexpected natural events such as floods and earthquakes. Define and preserve properties (lands, real estates) of individuals, communities and institutions, through different surveying and GIS tools. Use the codes of practice of all civil engineering disciplines effectively and professionally.
- To provide graduate civil engineers with intellectual, analytical and experimental skills including business, management of construction sites, quality assurance as well as environmental issues. Lead and supervise a group of designers and site or lab technicians.
- To improve the student professional skills in presenting problems, contacting customers and suppliers, building internal and external relations and establishing business models. To assure values, ethics and social responsibilities in practice.

### 9.2 Intended learning Outcomes

#### 9.2.1 Knowledge and Understanding:

Graduates from civil engineering should be able to demonstrate knowledge and understanding of:

- A1** The necessary concepts, principles and theories relevant to civil engineering such as: theory & analysis of structures – soil mechanics - properties of materials, Properties, behavior and fabrication of building materials – hydraulics - descriptive geometry and surveying.
- A2** The different necessary methods for designing civil structures and infrastructure elements through reinforced concrete and metallic structures analysis and design, geotechnics and foundations, hydraulics and hydrology, water resources, environmental and sanitary engineering, roadways and traffic systems, surveying and photogrammetry such as: design of reinforced concrete buildings – design of metallic buildings and bridges – design of foundations – design of canals, drains and water structures – design of harbors – design of railways and highways – maps projection and representation.
- A3** Some courses concerning business, ethical responsibilities and projects management needed in practice, including planning, finance, bidding and contracts.
- A4** Codes of practices in civil engineering disciplines and regularity framework in design and practices.

- A5** Broad education necessary to understand the impact of civil engineering solutions on the environment. Up-to-date technology relevant to civil engineering disciplines

### 9.2.2 Intellectual Skills

On successful complete of this program Graduates should be creative and must be able to:

- B1** Adopt, create and innovate thinking in solving problems, design techniques and codes of practice in civil engineering disciplines, for modeling, analyzing and solving engineering problems.
- B2** Analyze and interpret data from field or laboratory experiments to get necessary conclusions needed for design. Selecting the optimum design of civil structures and applies appropriate IT tools to a variety of engineering problems.
- B3** Solve (analytically and graphically) the engineering problems which may arise in the site during construction
- B4** Adopt appropriate mathematical principles, natural sciences, technology, computing methods, design techniques and codes of practice in civil engineering disciplines, for modeling, analyzing and solving engineering problems.
- B5** Apply appropriate structural analysis and codes of practice in designing reinforced concrete and metallic structures of all types
- B6** Applies appropriate geotechnical technique and codes of practice to determine levels, types and design systems of building foundations and excavations. Assess risks and safety precautions covering neighboring buildings, laborers and people during construction
- B7** Evaluate and investigate risks, and take suitable steps to manage them. Define, plan, conduct and report management techniques. Assess and evaluate different techniques and strategies for solving engineering problems.
- B8** Solve engineering problems, on the basis of limited and possibly contradictory information. Maintain a sound theoretical approach in dealing with new and advancing technology

### 9.2.3 professional Skills

Graduates will have the following skills:

- C1** Analyze and design of different of civil structures using specialized computer software, computational tools and packages.
- C2** Using laboratory and field equipment and techniques for measurements competently and safely. Observe record and analyze data in laboratory as well as in the field.
- C3** Developing the sense of solving problems that may face the engineer in the site and preparing the necessary reports and give technical presentations.
- C4** Evaluate systems and project items carried out by contractors. Demonstrate basic organizational and construction management skills, manage the project and give the right decision. Prepare quantity surveying reports.
- C5** The ability to deal with customers and suppliers. Developing the sense of solving problems that may face the engineer in the site and preparing the necessary reports. Technical report writing and give presentations.

### 9.2.4 General Skills

Graduating civil engineers should have transferable skills. These skills include ability to:

- D1** Team work, ability to work in multidisciplinary team and communication effectively with colleagues and others.

- D2** Ideas development and sharing with others, ability to suggest alternatives to solve site problems.
- D3** Ability to interpret the result, ability to improve own learning and performance.
- D4** Time management and projects organization, ability to manage the project and give the right decision.
- D5** Ethical behavior with peers, superiors.

**Academic standards for Mining & Metallurgical Eng. program****10**

Mining & Metallurgical Engineering is a branch of Engineering deals with knowledge and skills of ore extraction from the earth crust , ore processing , surveying, geostatistics, rock mechanics, metallurgical processes and environmental Engineering.

Mining & Metallurgical Engineering studies helps in improving the life quality and increase the natural income from the natural resources . Therefore , the distinguished educational levels will lead to different specializations that could help in improving the graduates .

The period of educational program must not be less than five years in addition to practical and training experiences these all need an integrated , approved , suitable program . This program permits the diversity in different educational and responses of local environment and elastic in dealing .

Mining and Metallurgical Engineers are responsible for the nation and community , at the mean time this field is in need for nations , national or international higher standards are required .

**10.1 Charcteristics of Mining and Metallurgical Engineer**

In addition to the general attributes of engineer , the mining and metallurgical engineer should be able to .

- a- acquire knowledge of basic principles of mining and metallurgy supported by the necessary background science .
- b- Apply the advanced sciences and engineering principles to mining operations and metallurgical processes .
- c- Have an integrated understanding of the scientific and engineering principles underlying the five major elements of the field of mining and metallurgical engineering , ore prospecting , mine and quarries , ore preparation and concentration , metallurgical processing , metal shaping and treatment .

- d- Apply integrate knowledge from each of the five dementis of mining and metallurgical engineering to solve the problems of processes and to select the ore preparation as well as mining method .
- e- Acquire key practical skill and competence .
- f- Have the ability to design and execute an individual project .
- g- Have an awareness of importance of the different types of ores and building materials .
- h- Have an awareness of sustainability and environmental issues .
- i- Use the relevant mathematical and computational skills in solving mining , ore dressing , Extractive and physical metallurgical engineering problems .

The graduate of the mining and Metallurgical engineering should have the ability of principle applications of theoretical background , subjects , terminology , skills in several levels as follows :

- 1- Design of mine and quarries .
- 2- Mine planning .
- 3- Project management
- 4- Planning of mineral processing plants .
- 5- Mine geostatistics.
- 6- Mine blasting .
- 7- Environmental and pollution control .

## **10.2 academic reference standards for mining and metallurgical engineer**

The following academic reference standards represent the general expectation about the qualifications attributes and capabilities that the graduates of mining and metallurgical engineering program should be able to demonstrate .

### **10.2.1 Knowledge and understanding**

Program graduates should be able to demonstrate knowledge and understanding of:

- 1- Principles of physical for interpretation the physical meaning of different phenomena.
- 2- Drawing the simple mechanical parts, as well as, flow sheets.
- 3- Principles of production engineering to evaluate the capacity and efficiency of machines, as well as, their maintenance.
- 4- Statistical methods necessary to evaluate the ore reserves.
- 5- Principles of structure and stress distribution above mine opening.
- 6- Physical and mechanical properties of rock, as well as, metals.
- 7- Developing the awareness towards the use of new materials such as ceramics and composite materials.
- 8- Unit operations and qualitative and quantitative flow sheets for mining, mineral processing and metallurgical fields.
- 9- Chemical and mineralogical composition of the ore.
- 10- Material and heat balances of ore preparation and metal extraction.
- 11- The role of mining engineer to create safe and clean environment

#### **10.2.2 Intellectual skills**

On successful completion of this program student should be able to:

- 2- Apply the mathematical and statistical methods to classify the ore reserves ( proved, probable, impossible )
- 3- Use mathematical principles for modeling mining and metallurgical operations.
- 4- Predict the effect of mineralogical compositions of the ores on process performance.
- 5- Evaluate and control environmental pollutants in mines and quarries.
- 6- Use software programs for solving problems related to mining and metallurgical fields.
- 7- Develop the trend of feasibility study, as well as, expected benefits of mining and metallurgical projects.



- 8- Think about the alternative solutions of any mining and metallurgical engineering problems.
- 9- Solve the technical problems related to mining, dressing and metallurgical plants.
- 10- Suggest some unconventional design solutions for the problems related to mining industry.

#### **10.2.3 Professional skills**

- 1- Graduates will have the following professional skills:
- 2- Selection the suitable experimental design methods, as well as non-destructive tests.
- 3- Use of novel apparatuses in the different branches of the field.
- 4- Apply the safety regulations to avoid the professional diseases.
- 5- Ability to solve the fine powders problems.
- 6- Using the environmental impact devices to measure the air and water pollutants.
- 7- Prepare the projects in a professional way.

#### **10.2.4 General Skills**

- 1- Students completing the program will have the following general skills:
- 2- Ability to use the software packages related to mining and metallurgical field.
- 3- Manipulation and presentation of data.
- 4- Ability to set the shift time table and manage the work.
- 5- Ability to be integrated in team work.
- 6- Ability to Keep the professional ethics and create a sustainable environmental development for communities and the requirements of local, national and international levels.
- 7- Ability to discuss, analyze, criticism, introduce the ideas in a scientific manner.

## المعايير الأكاديمية لبرنامج الهندسة المعمارية

### مقدمة

يستقي تخصص العمارة المعرفة والمهارات من العلوم الإنسانية والطبيعية والإنسانيات والفنون الجميلة والتطبيقية، وهو يعبر عن استيعاب الأنشطة الإنسانية في أي مكان تحت كل الظروف من خلال فهم المكان بتنوعه المادي والتاريخي والثقافي والاجتماعي والسياسي والبيئي.

وتسهم العمارة في تشكيل البيئة المبنية التي نعيش فيها من خلال التوافق بين الفراغات والمباني والمدن وعناصر التنسيق الطبيعية، لذلك فإن التعليم المعماري يتميز بالغني والتنوع والتخصصات المتداخلة.

يجب ألا تقل فترة التعليم المعماري عن خمس سنوات (بخلاف الخبرات العملية والتدريبية وغيرها) تدرس من خلال برنامج معماري معتمداً على نظام التفرغ الكامل، من خلال برنامج معماري جامعي محدد ومعتمد وصالح، ويسمح بالتنوع في المداخل التربوية والاستجابة للبيئات المحلية ومرونة التعامل.

والمعماريين المتخصصين عليهم واجبات أساسية للعناية بالمجتمع الذي يخدمونه، ففي عالم تتزايد في الحاجة إلى التخصص نجد أنه هناك احتياج لمعايير محلية وعالمية للتعليم المعماري.

### 1-11 سمات المهندس المعماري:

يجب أن يمتلك خريج العمارة القدرة على تطبيق المبادئ والأسس والنظريات والموضوعات والطرق للمفاهيم والمهارات التالية وتطبيقها على المستويات المتعددة:

- أ- التصميم المعماري
- ب- التخطيط الحضري والإقليمي وطرق التنمية والنقد والتقييم للخطط على مستويين مختلفين من البيئة
- ج- التصميم الحضري وتخطيط المواقع
- د- إدارة المشروعات
- هـ- تقنيات البناء والتصميم البيئي (الصوتيات - الإضاءة - المناخ - وغيرها)

### 2-11 المعايير الأكاديمية لبرنامج الهندسة المعمارية:

#### 1-2-11 المعرفة والفهم:

- 1- البحث والتعريف والشرح للمشكلات المعمارية ومشكلات التخطيط العمراني.
- 2- فهم نسيج ومشاكل المدينة على المستويات الإقليمية والحضرية والمحلية.

- أ3- التعرف على أهمية الفراغات الحضرية والتأثيرات المتبادلة بين الإنسان والعناصر المرئية للمدينة.
- أ4- معرفة وفهم تاريخ العمارة وتطور نظريات العمارة في الماضي وحتى الوقت المعاصر.
- أ5- التعرف على دور ومسؤولية المعماري والمخطط في خلق بيئة مستدامة ملائمة لاحتياجات المجتمع المعينة سواء الاجتماعية والاقتصادية والثقافية على المستوى المحلي والقومي والإقليمي والدولي.
- أ6- التعرف على أهمية الرياضيات والعلوم الطبيعية والمعلومات الهندسية في العمارة ودور المعماري في محاكاة ونمذجة البيئة المادية وعملياتها وتطبيق مثل تلك المعلومات على البيئة المبنية.
- أ7- معرفة وفهم قواعد وأسس التصميم الابتدائي والنهائي والرسومات التفصيلية والتفاصيل للتصميم المعماري والتخطيط الحضري.
- أ8- فهم السلوك الإنشائي للمباني وعناصر الإنشاء ومواد البناء للأنظمة الإنشائية المتعددة.
- أ9- التعرف على مفاهيم وطرق وتقنيات واقتصاديات وأساليب إدارة عمليات إنشاء المباني وكذلك مراحلها وعناصرها ومواد البناء.
- أ10- التعرف على مفاهيم وطرق وتقنيات عمليات التركيبات الميكانيكية والتي تشمل على أنظمة الإنشاء والمياه والصرف الصحي وتكييف الهواء والصوتيات والإضاءة.
- أ11- التعرف على تقنيات البناء المتقدمة.

## 11-2-2 المهارات الذهنية

- ب1- التفكير بمنهجية أثناء مراحل العملية التصميمية وصولاً لتنفيذ العمل المعماري، وتحليل المشكلات المعمارية والعمرانية، واقتراح بدائل الحلول، والترجيح بينها لاختيار أفضل البدائل.
- ب2- اقتراح حلول وأفكار ومفاهيم غير تقليدية تخدم عملية التخطيط والتصميم والتنفيذ.
- ب3- حل المشكلات التصميمية والتخطيطية بجميع أنواعها مع التركيز على تحليل الاحتياجات وإنتاج حلول مبتكرة.
- ب4- حل المشكلات التقنية والإنشائية للمبنى وتحليل عناصرها وتفاصيلها وأساليب الإنشاء ومواد البناء
- ب5- اختيار واستخدام نماذج إنشائية مبتكرة.

## 11-2-3 المهارات المهنية

- ج1- اكتساب المهارات المطلوبة للمعماري والمخطط مثال: (مهارات القراءة والفهم والتحليل والتعبير عن الأفكار الإبداعية والمفاهيم باستخدام رسومات معمارية ذات جودة عالية مساقت وأعمال ورسومات وخرائط ومستندات ونماذج ثلاثية الأبعاد وغيرها)
- ج2- طرح حلول موضوعية وإنتاج تكوينات تشكيلية مبتكرة تتوافق مع الواقع المجتمعي.
- ج3- اكتساب القدرة على عرض المشروعات المعمارية.
- ج4- إعداد التقارير الفنية والعلمية بشكل احترافي.

- ج5- الإلمام بمواد البناء وتقنيات الإنشاء المستخدمة والقدرة على اختيار أفضلها حسب الموقف التصميمي.
- ج6- إعداد وتفسير الرسومات التقنية (المعمارية والإنشائية والميكانيكية و الهندسية و تكييف الهواء والمياه والصرف الصحي) باستخدام كل من تقنيات الرسم اليدوية وباستخدام برامج الحاسب الآلي.
- ج7- إدارة عمليات التشييد والبناء.
- ج8- القدرة على القيام بالتجارب المعملية والحقلية المتعلقة وتحليل النتائج وتفسيرها.
- ج9- القدرة على تحليل وتقييم معطيات الواقع المحلي وبيئة العمل الاجتماعية والاقتصادية والسياسية.

#### 11-2-4 المهارات العامة

- د1- التعرف على أخلاقيات الممارسة المهنية للعمارة
- د2- التعبير عن الرأي والثقة بالنفس والاتصال بكفاءة مع الزملاء والمجتمع الخارجي مستخدماً الأساليب المختلفة من الكتابة والعروض الشفهية والمرئية.
- د3- تنمية قدرات التفكير المنطقي في حل المشكلات من خلال المناقشة وتقديم الأفكار بطرق منهجية موضوعية علمية تحترم وتستخدم أفكار الآخرين.
- د4- العمل بفاعلية كعضو من فريق متعدد التخصصات.
- د5- إدارة وتنظيم العمل الجماعي أو العمل متعدد التخصصات.
- د6- التعامل مع المعرفة وتنظيم المعلومات.
- د7- يكتسب القدرة على التعليم الذاتي والحافزية للعمل والتعلم باستقلالية دون الاعتماد على الغير بعقل منفتح.
- د8- التعلم بكفاءة من أجل استمرارية التطوير المهني في محيط عمله المهني.
- د9- الوعي العام بالأنواع المختلفة من المعرفة بالحياة الإنسانية والثقافية.

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Assiut University  
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# المعايير الأكاديمية

## لكلية الهندسة – جامعة أسيوط

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