



# INTRODUCTION TO ENGINEERING DISCIPLINES

(With Relevant Information on Engineers in Society)



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# COMPUTER ENGINEERING DISCIPLINE

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CHAPTER

5

## COURSE SYNOPSIS

### **Computer Engineering**

*Introduction to computer engineering profession; Definition of computer engineering. Specializations/Options in computer engineering, Use of various equipment in computer engineering for different operations/processes. Prospects and job opportunities in computer engineering as a profession; Relevant regulatory bodies and societies in computer engineering. The role of computer engineers in advancement of humanity.*

### **5.1 INTRODUCTION TO BIOMEDICAL ENGINEERING DISCIPLINE**

### **5.2 DEFINITION**

Computer Engineering is a discipline that incorporates several aspects of electrical and electronics engineering with computer science in order to develop computer-based systems. This field of engineering seeks to enhance the capability, functionality, usability and applicability of computers to meet individual and collective needs in different aspects of life.

It entails the development of improved computer hardware and software systems and how they can be integrated into other machines, materials, devices and systems to accomplish more and perform better. It also involves the building of networks for computer communication, human-computer interaction and transfer of data. Several techniques are constantly being developed to improve computer systems by making them faster, smarter, more efficient, more mobile and more adaptable to solve various problems.

Computer Engineers usually have training in electrical and electronic engineering, computer science and hardware-software integration for different applications, such as the design of microprocessors and Very Large Scale Integration (VLSI) chips, writing of software and firmware for embedded systems, designing of sensors, mixed signal circuit boards, operating systems for personal and supercomputers. Robotics, automation and computer vision are also included as areas of applications where digital systems are employed to control and monitor electrical systems, while taking strategic decisions dynamically and autonomously.

## 5.3 SPECIALIZATION/ OPTIONS IN COMPUTER ENGINEERING

### 5.3.1 Embedded Systems and Automation

Embedded systems are specialized computer systems designed to carry out specific functions in a larger electrical or mechanical systems. Embedded systems are found in many devices from cell phones to unmanned space crafts. Automation involves the full, partial or graded application of computer systems to carry out various functions that would have been carried out through human effort. The study of these systems constitutes an area of specialization in computer engineering which applies the knowledge of electronics, artificial intelligence, instrumentation and control to automate home appliances, office equipment, automobiles as well as small and large scale industrial machines. Computer Engineers in this area design computer systems which enhance the speed, reliability, efficiency and performance of larger systems.

### 5.3.2 Computer Communications and Networks

This area of specialty aims to advance technology from the frontiers of data communication, computer networking, telecommunications systems and networks (both wired and wireless networks), modulation, information theory, error-control coding and correction. Research is constantly on-going to explore new frequency bands, frequency re-use, and dynamic spectrum usage and to increase the efficiency of communication channels. Computer Engineers in this area help to design and analyze high-speed network, fault-tolerant systems, storage and transmission schemes while improving modulation techniques and interference suppression methods.

### 5.3.3 Computer Systems Architecture

This involves the design of the principles, guidelines, models and organization of components that define the operation, functionality and implementation of computer systems. Computer Engineers in this specialty research into techniques to develop reliable, secure, testable and high-performance computer systems. Projects handled include the design of more efficient processors and coprocessors for multi-threading and parallel processing, enhancing the energy efficiency of VLSI circuits, simulating discharge protection for Complimentary Metal-Oxide-Semi-Conductor (CMOS) circuits, improving computer storage, development of new theories and algorithms **to build highly-reliable and secure computer hardware** with other tools that improve the performance of computer systems.

### 5.3.4 Cryptography and Information Security

The aim of this area is to secure information being transmitted, received and stored. It is premised on the practice of protecting information from unauthorized access, copyright infringement and other forms of tampering. Computer Engineers in this specialization work on coding to detect and correct errors caused by distortions in the process of transmitting, storing or compressing information. Cryptography, a research area in this specialty, utilizes the knowledge of encryption to protect data by transforming the data or information into a form unusable for unauthorized users.

challenges in telecommunication relating to the management of radio resources.

9. Computer Engineers help to advance research in the line of creating autonomous and decision support systems that can aid human effort in various places. For example, repetitive tasks can be more cheaply, quickly and accurately carried out compared to what humans will do when faced with such tasks.
10. Computer Engineers in the field of robotics have helped to build advanced humanoid, explorer and navigation robots that work effectively and almost independently in multitasking environments such as in hospitals, automobile assembly industries, electronic assembly plants etc. These robots are also very effective and useful in environments that pose great danger to humans such as in oceans while searching for sunken ships or aircrafts, in fire disasters or while cleaning up nuclear wastes.
11. A Software Engineer also play significant roles in transforming the social life by creating, designing, improving and maintaining the multimedia software in music players, games, television sets and public address systems etc. Transfer of data, music or video files are now easier than ever using technologies such as Bluetooth and other wireless based connectivity techniques.
12. Computer Engineers have also made and continue to make impact in the domestic life of humans as improved computer system softwares and capabilities have been embedded into domestic appliances such that almost all appliances used in the homes have now become smarter and easier to use with the ability to almost think on their own. Washing machines, dishwashers, microwaves and many more appliances are better programmed to suit the needs and desires of the users.
13. The world is fast becoming a global village through improvement in the quality of social networking sites and their enhanced capabilities which is one of the roles of a computer software engineer in advancing the effectiveness and capabilities of the internet. Communication is indeed much easier, much faster and much more effective.
14. Security has also been enhanced through the creation of more sophisticated information protection softwares by Computer Engineers in the line of encryption. Unauthorized invading of personal and sensitive data can now be avoided using tools developed by computer engineers.
15. Computer engineers have contributed immensely to the quality of Computer aided design (CAD) softwares and computer aided manufacturing (CAM) techniques by joining isolated computerized systems into integrated networks to boost the productivity of many factories.

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