



وزارة التعليم
Ministry of Education



جامعة المستقبل
Mustaqbal University
أول جامعة أهلية بمنطقة القصيم

College of Engineering and Computer Science

Computer Engineering Program

Program Manual

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MUSTAQBAL UNIVERSITY
COLLEGE OF ENGINEERING AND COMPUTER SCIENCE
COMPUTER ENGINEERING PROGRAM

Program Manual, 2022

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College Vision

A nationally distinguished college in education and community partnership in the fields of engineering and computer science.

College Mission

Providing distinguished education and enhancing the skill side in the fields of engineering and computer science, to prepare qualified graduates with skills and knowledge and to ensure their equipment to meet the changing demands of the labor market and society, through the development of technologies and innovation.

College Objectives

1. Providing distinguished education that contributes to achieving economic development and meets the requirements of the public and private sectors.
2. Preparing distinguished graduates in terms of knowledge and skill in the fields of engineering and computer science who are able to successfully engage in various fields of work.
3. Preparing graduates capable of developing their skills and pursuing higher education.
4. Preparing graduates capable of serving the community and meeting its needs.
5. Preparing graduates capable of leadership in various areas of professional life.

Department Vision

To become a national leader in providing high quality education in the area of computer engineering and computer network.

Department Mission

To excel in embracing knowledge and continuing education; to be recognized as a program that offers one of the best programs in computer engineering and computer network; to provide an environment in which students are given the essential resources to address and solve real-world problems; and to promote active learning, critical thinking, and engineering judgment. In addition, offering internship, co-op and continuing education programs that produce graduates for the highest paid jobs.

Educational Objectives

Providing distinguished education that contributes to:

1. Demonstrate success in the professional practice of computer and network engineering by interacting with members of professional teams in industry, government, and other organizations.
2. Keep students' professional knowledge updated through continuously learning new concepts and identifying the new directions in areas of computer engineering and network engineering.
3. Have good manners in their professional environment and develop skills to enhance the state of their practice in a dynamic professional environment.

1 Introduction

In its second strategic principle, the Saudi National Science and Technology Policy stresses the necessity of activating education in the scientific and technological fields necessary for development. In its tenth strategic principle, the policy also emphasized the need to absorb, develop and use information technology to enhance the interaction and benefit of information that supports development. The Department of Computer Engineering responds to these principles by providing highly skilled human resources in computer engineering and network engineering, which covers the required professions such as computer engineer, communications engineer, network engineer, and systems engineer.

1.1 Vision

To become a national leader in providing high-quality education in the area of computer engineering and computer network.

1.2 Mission

To excel in embracing knowledge and continuing education; to be recognized as a program that offers one of the best programs in computer engineering and computer network; to provide an environment in which students are given the essential resources to address and solve real-world problems; and to promote active learning, critical thinking, and engineering judgment. In addition, offering internship, co-op, and continuing education programs that produce graduates for the highest-paid jobs.

1.3 Objective

- Demonstrate success in the professional practice of computer and network engineering by interacting with members of professional teams in the industry, government, and other organizations.
- Keep students' professional knowledge updated through continuously learning new concepts and identifying the new directions in areas of computer engineering and network engineering.
- Have good manners in their professional environment and develop skills to enhance the state of their practice in a dynamic professional environment.

2 Program Learning Outcomes

2.1 Knowledge and Understanding

- K1 apply knowledge of mathematics, science, and engineering,

- K2 understanding of professional and ethical responsibility
- K3 understand the impact of engineering solutions in a global and societal context
- K4 knowledge of contemporary issues
- K5 a familiarity with statistics and linear algebra and the ability to apply advanced mathematics through multivariate calculus and differential equations

2.2 Skills

- S1 design and conduct experiments, as well as to analyze and interpret data
- S2 design an engineering system, component, or process to meet desired needs
- S3 analyze, design, and implement software and hardware computer systems
- S4 identify, formulate, and solve engineering problems
- S5 communicate effectively

2.3 Values

- V1 a recognition of the need for and an ability to engage in lifelong learning
- V2 use the techniques, skills, and modern engineering tools necessary for engineering practice
- V3 function on multi-disciplinary teams

3 Opportunity Career

There are many career fields that graduates of the Computer Engineering major can work in, including:

1. Jobs related to computer engineering work, such as preparing research, studies, reports, and recommendations in the fields of computers, examining, installing, and maintaining computers, supervising these works, and carrying out other work related to this field. Examples of computer engineering work:
 - Designing magnetic slides, computers, designing memories, and magnetic storage.
 - Building, developing, installing, and setting specifications for computers and various digital circuits.

- Maintaining computers, linking them to networks, and using them in control and communications applications.
 - Follow up on spare parts and other maintenance needs and prepare the necessary lists for that.
 - Determine the appropriate devices in the project operations for the main devices of main computers and personal computers.
2. Specialized jobs for computer engineering and network engineering.
- Communications engineering jobs (seventh rank in the civil service).
 - Computer engineering jobs (seventh rank in the civil service).
3. Operations Jobs for Network Engineering major.
- Communications technician jobs (seventh rank in the civil service).
 - Information technology project management jobs (seventh rank in the civil service).
 - Support technician jobs (seventh rank in the civil service).

4 Program System

The computer engineering program provides highly skilled human resources in computer engineering and network engineering, which covers the most effective skills and knowledge in computer engineering and networks. The computer engineering program has two tracks: the computer engineering track and the network engineering track. To gain the B. Sc. degree in the computer engineering program, 164 credit hours must be completed as mentioned in the program plan. The program plan is distributed among ten semesters. The credit hours for the semester are between 16-17 credit hours. The following table illustrates the computer engineering program credit hour distribution among the university, college, and program requirements.

Category	Course Type	Credit
University Requirements		11
2*College Requirements	Compulsory	73
	Elective	5
2*Program Requirements	Compulsory	69
	Elective	6
Program Total Credits		164

5 Computer Engineering Track

Table 1: University Requirements

2*Course Code	2*Number	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requirement
IAS	101	Practical Grammar	2 (2, 0,0)	None
IAS	111	Belief & its Consequences	2 (2,0,0)	None
PE	001	Prep. Physical Educ. I	1(1,0,1)	None
IAS	201	Writing for Professional Needs	2(2,0,0)	IAS 101
IAS	212	Professional Ethics	2(2,0,0)	IAS 111
IAS	311	Islamic Shariah	2(2,0,0)	IAS 212
Total			11	

Table 2: College Requirements, Compulsory

2*Course Code	2*Number	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requirement
LS	101	Learning Skills	3(3,1,0)	None
MGT	001	Entrepreneurship	1(1,1,0)	None
MATH	101	Calculus-I	4(4,1,0)	None
CS	285	Discrete Math for Computer	3 (3,1,0)	MATH 102
MATH	102	Calculus-II	4 (4,1,0)	MATH 101
MATH	201	Calculus III	3 (3,1,0)	MATH 102
MATH	260	Linear Algebra & Diff Equations	3 (3,1,0)	MATH 102
STAT	219	Prob. & Stat. For Eng. & Sc.	3 (2,0,3)	MATH 201
CHEM	101	General Chemistry	4 (3,0,3)	-
PHYS	101	General Physics-I	4(3,1,3)	MATH 101
PHYS	102	General Physics-II	4 (3,1,3)	PHYS 101
CS	111	Computer Skills	3(2,0,3)	None
ENGL	001	Prep. English I	6(2,0,12)	None
ENGL	002	Prep. English II	6(2,0,12)	ENGL 001
ENGL	101	Introduction to Acad. Discourse	3 (3,0,0)	ENGL 002
ENGL	102	Intro To Report Writing	3 (3,0,0)	ENGL 101
ENGL	214	Academic & Professional Comm.	3 (3,0,0)	ENGL 102
CS	101	Computer Programming I	4 (3,0,3)	MATH 101
IE	199	Intro. to Engineering and Design	3(2,1,3)	None
IE	332	Engineering Economy	3 (3,0,0)	MATH 102
IE	412	Project Management	3 (3,0,0)	MATH 201
Total			73	

Table 3: College Requirements, Elective

2*Course Code	2*Number	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requisite
COE/CS/EE	4XX	Technical Elective	3(3,1,0)	None
IAS	4XX	Islamic Elective	2(2,0,0)	None
Total			5	

Table 4: Program Requirements, Compulsory

2*Course Code	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requisite
COE 202	Digital Logic Design	3 (3,0,0)	PHYS 102
COE 203	Digital Logic Design Lab	1 (0,0,3)	PHYS 102
CS 102	Computer Programming II	4 (3,1,3)	CS 101
EE 202	Electric Circuits I	3 (3,1,0)	MATH 102, PYHS 102
COE 204	Computer Organization	3 (3,0,0)	COE 202
COE 205	Computer Organization Lab	1 (0,0,3)	COE 202
CS 210	Data Structures and Algorithms	3 (3,1,0)	CS 102
EE 206	Electric Laboratory I	1 (0,0,3)	EE 202
EE 220	Electronics I	3 (3,1,0)	EE 202
EE 270	Signal & System Analysis	3 (3,1,0)	EE 202
COE 304	Introduction to Embedded Systems	4 (3,0,3)	COE 204, CS 102
COE 342	Data & Computer Communication	4 (3,0,3)	COE 204, EE 270
CS 225	Software Eng. Design and Develop.	3 (3,1,0)	CS 102
EE 221	Electronics I Lab	1 (0,0,3)	EE 220
EE 370	Digital Signal Processing	3 (3,0,0)	EE 270
COE 344	Computer Networks	4 (3,0,3)	COE 342
COE 308	Computer Architecture	3 (3,0,0)	COE 204
CS 311	Design and Analysis of Algorithms	3 (3,1,0)	CS 102
CS 330	Operating Systems	4 (3,1,3)	CS 210
COE 402	Advanced Digital Systems Design	3 (3,0,0)	COE 204
COE 455	Introduction to Digital Control	3 (3,0,0)	EE 370
COE 460	Principles of VLSI Design	3 (3,0,0)	EE 220
COE 498	Design project-I	3 (3,0,0)	129 Cr.
COE 499	Design project-II	3 (3,0,0)	COE 498
Total		69	

Table 5: Program Requirements, Elective

2*Course Code	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requisite
COE 4xx	COE Elective I	3 (3,0,0)	None
COE 4xx	COE Elective II	3 (3,0,0)	None
Total		6	

Table 6: Program Requirements, Elective List

2*Course Code	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requisite
COE 410	Computer Arithmetic	3 (3,0,0)	None
COE 441	Data Center Networking	3 (3,0,0)	None
COE 443	High Speed Networks	3 (3,0,0)	None
COE 444	Internetwork Design & Management	3 (3,0,0)	None
COE 445	Internet Architecture and Technologies	3 (3,0,0)	None
COE 446	Computer & Network Security	3 (3,0,0)	None
COE 447	Fundamentals of Optical Networking	3 (3,0,0)	None
COE 448	Wireless & Mobile Networks	3 (3,0,0)	None
COE 482	Artificial Intelligence in Computer Engineering	3 (3,0,0)	None
COE 484	Introduction to Robotics	3 (3,0,0)	None
Total		6	

Table 7: Program Requirements, Technical Elective List

2*Course Code	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requisite
EE 420	Digital Communications	3 (3,0,0)	None
EE 425	Wireless Communications	3 (3,0,0)	None
EE 426	Satellite Communications	3 (3,0,0)	None
EE 427	Optical Communications	3 (3,0,0)	None
CS 340	Introduction to Database Systems	3 (3,0,0)	None
CS 412	Theory of Computation	3 (3,0,0)	None
Total		3	

6 Network Engineering Track

Table 8: University Requirements

2*Course Code	2*Number	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requirement
IAS	101	Practical Grammar	2 (2, 0,0)	None
IAS	111	Belief & its Consequences	2 (2,0,0)	None
PE	001	Prep. Physical Educ. I	1(1,0,1)	None
IAS	201	Writing for Professional Needs	2(2,0,0)	IAS 101
IAS	212	Professional Ethics	2(2,0,0)	IAS 111
IAS	311	Islamic Shariah	2(2,0,0)	IAS 212
Total			11	

Table 9: College Requirements, Compulsory

2*Course Code	2*Number	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requirement
LS	101	Learning Skills	3(3,1,0)	None
MGT	001	Entrepreneurship	1(1,1,0)	None
MATH	101	Calculus-I	4(4,1,0)	None
CS	285	Discrete Math for Computer	3 (3,1,0)	MATH 102
MATH	102	Calculus-II	4 (4,1,0)	MATH 101
MATH	201	Calculus III	3 (3,1,0)	MATH 102
MATH	260	Linear Algebra & Diff Equations	3 (3,1,0)	MATH 102
STAT	219	Prob. & Stat. For Eng. & Sc.	3 (2,0,3)	MATH 201
CHEM	101	General Chemistry	4 (3,0,3)	-
PHYS	101	General Physics-I	4(3,1,3)	MATH 101
PHYS	102	General Physics-II	4 (3,1,3)	PHYS 101
CS	111	Computer Skills	3(2,0,3)	None
ENGL	001	Prep. English I	6(2,0,12)	None
ENGL	002	Prep. English II	6(2,0,12)	ENGL 001
ENGL	101	Introduction to Acad. Discourse	3 (3,0,0)	ENGL 002
ENGL	102	Intro To Report Writing	3 (3,0,0)	ENGL 101
ENGL	214	Academic & Professional Comm.	3 (3,0,0)	ENGL 102
CS	101	Computer Programming I	4 (3,0,3)	MATH 101
IE	199	Intro. to Engineering and Design	3(2,1,3)	None
IE	332	Engineering Economy	3 (3,0,0)	MATH 102
IE	412	Project Management	3 (3,0,0)	MATH 201
Total			73	

Table 10: College Requirements, Elective

2*Course Code	2*Number	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requisite
COE/CS/EE	4XX	Technical Elective	3(3,1,0)	None
IAS	4XX	Islamic Elective	2(2,0,0)	None
Total			5	

Table 11: Program Requirements, Compulsory

2*Course Code	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requisite
COE 202	Digital Logic Design	3 (3,0,0)	PHYS 102
COE 203	Digital Logic Design Lab	1 (0,0,3)	PHYS 102
CS 102	Computer Programming II	4 (3,1,3)	CS 101
EE 202	Electric Circuits I	3 (3,1,0)	MATH 102, PYHS 102
COE 204	Computer Organization	3 (3,0,0)	COE 202
COE 205	Computer Organization Lab	1 (0,0,3)	COE 202
CS 210	Data Structures and Algorithms	3 (3,1,0)	CS 102
EE 206	Electric Laboratory I	1 (0,0,3)	EE 202
EE 220	Electronics I	3 (3,1,0)	EE 202
EE 270	Signal & System Analysis	3 (3,1,0)	EE 202
COE 304	Introduction to Embedded Systems	4 (3,0,3)	COE 204, CS 102
COE 342	Data & Computer Communication	4 (3,0,3)	COE 204, EE 270
CS 225	Software Eng. Design and Develop.	3 (3,1,0)	CS 102
EE 221	Electronics I Lab	1 (0,0,3)	EE 220
EE 370	Digital Signal Processing	3 (3,0,0)	EE 270
COE 344	Computer Networks	4 (3,0,3)	COE 342
COE 308	Computer Architecture	3 (3,0,0)	COE 204
CS 311	Design and Analysis of Algorithms	3 (3,1,0)	CS 102
CS 330	Operating Systems	4 (3,1,3)	CS 210
COE 444	Internetwork Design & Management	3 (3,0,0)	COE 344
COE 446	Computer & Network Security	3 (3,0,0)	COE 344
COE 448	Wireless & Mobile Networks	3 (3,0,0)	COE 344
COE 498	Design project-I	3 (3,0,0)	129 Cr.
COE 499	Design project-II	3 (3,0,0)	COE 498
Total		69	

Table 12: Program Requirements, Elective

2*Course Code	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requisite
COE 4xx	Computer Networks Elective I	3 (3,0,0)	None
COE 4xx	Computer Networks Elective II	3 (3,0,0)	None
Total		6	

Table 13: Program Requirements, Elective List

2*Course Code	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requisite
COE 441	Data Center Networking	3 (3,0,0)	None
COE 443	High Speed Networks	3 (3,0,0)	None
COE 445	Internet Architecture and Technologies	3 (3,0,0)	None
COE 447	Fundamentals of Optical Networking	3 (3,0,0)	None
COE 449	Special Topics in Computer Networks	3 (3,0,0)	None
Total		6	

Table 14: Program Requirements, Technical Elective List

2*Course Code	2*Course Title	Cr. Hr. (L, T, Lab)	Pre-requisite Or Co-Requisite
COE 402	Advanced Digital Systems Design	3 (3,0,0)	None
COE 410	Computer Arithmetic	3 (3,0,0)	None
COE 455	Introduction to Digital Control	3 (3,0,0)	None
COE 460	Principles of VLSI Design	3 (3,0,0)	None
COE 482	Artificial Intelligence in Computer Engineering	3 (3,0,0)	None
COE 484	Introduction to Robotics	3 (3,0,0)	None
EE 420	Digital Communications	3 (3,0,0)	None
EE 425	Wireless Communications	3 (3,0,0)	None
EE 426	Satellite Communications	3 (3,0,0)	None
EE 427	Optical Communications	3 (3,0,0)	None
CS 340	Introduction to Database Systems	3 (3,0,0)	None
CS 412	Theory of Computation	3 (3,0,0)	None
Total		3	

7 Courses Description

- **MATH 102 Calculus II Credits and contact hours: 4 (4,1,0)**

Definite and indefinite integrals of functions of a single variable. Fundamental Theorem of Calculus. Techniques of integration. Hyperbolic functions. Applications of the definite integral to the area, volume, arc length, and surface of revolution. Improper integrals. Sequences: convergence tests, integral, comparison, ratio, and root tests. Alternating series. Absolute and conditional convergence. Power series. Taylor and Maclaurin series.

Prerequisite: MATH 101

- **CHEM 101 General Chemistry I Credits and contact hours: 4 (3,0,3)**

Matter, atomic structure and the periodic table, chemical bonding, stoichiometry of pure substances, the reaction in aqueous solutions, states of matter (gases, liquids, and solids), mixtures (with emphasis on some physical aspects of solutions), and thermochemistry.

Laboratory: Qualitative and quantitative aspects of general chemistry.

Prerequisite: None

- **ENGL 101 Introduction to Academic Discourse Credits and contact hours: 3 (3,0,0)**

This course is designed to enable students to recognize and interpret the various modes of spoken and written academic discourse and to produce written documents related to what they have read. The main writing skills component of the course teaches students to make use of the principal modes of exposition and various types of academic correspondence common in English to write well-organized texts. The course's reading skills element focuses on improving students' reading of scientifically-oriented college-level textbooks and specialist articles and familiarizing them with the organizational and typographical features (glossaries, indices, headings, bold-face, italics, etc.) of such texts. The course's oral skills element introduces students to academic oral communication in the classroom and tutorial interaction. The electronic skills taught are intended to complement the written and oral skills by enabling students to use state-of-the-art internet and database search techniques to locate the information they require for expository composition writing and class-related tasks. Students must also maintain a portfolio (including a reflective journal) exhibiting their efforts, progress, and achievement throughout the course.

Prerequisite: ENGL 002

- **PHYS 102 General Physics II Credits and contact hours: 4 (3,1,3)**

A continuation of PHYS 101. Topics covered include wave motion and sound; temperature, first and the second law of thermodynamics; kinetic theory of gases;

Coulomb's law; the electric field; Gauss' law; electric potential; capacitors and dielectrics; D.C. circuits; the magnetic field; Ampere's and Faraday's laws.

Prerequisite: PHYS 101, Co-requisite: MATH 102

- **IAS 201 Writing for Professional Needs Credits and contact hours: 2 (2,0,0)**
Characteristics and types of formal writing: reports; scientific research; summaries; forms resume; evaluations and minutes of meetings.

Prerequisite: IAS 101

- **MATH 201 Calculus III Credits and contact hours: 3 (3,1,0)** Polar coordinates, polar curves, area in polar coordinates. Vectors, lines, planes, and surfaces. Cylindrical and spherical coordinates. Functions of two and three variables, limits, and continuity. Partial derivatives, directional derivatives. Extrema of functions of two variables. Double integrals, double integrals in polar coordinates. Triple integrals, triple integrals in cylindrical and spherical coordinates.

Prerequisite: MATH 102

- **STAT 219 Probability and Statistics for Engineers and Scientists Credits and contact hours:3 (2,0,3)**

Presentation and interpretation of data, elementary probability concepts, random variables, and probability distributions, binomial, Poisson, exponential, Weibull, normal and lognormal random variables. Estimation, tests of hypotheses for the one sample problem. Simple and multiple linear regression, application to engineering problems. The lab session will be devoted to problem-solving using statistics software.

Prerequisite: MATH 102

- **ENGL 102 Introduction to Report Writing Credits and contact hours: 3 (3,0,0)**

This course sets out to develop students' spoken and written communication skills in English, particularly regarding the production of a researched academic/professional report. The writing skills component includes paraphrasing and synthesis of ideas from several different sources for expository composition and term report writing; training in composing various types of formal correspondence to enable students to function well in the university setting; the researching (library and internet), organizing, and writing of an academic term report in which students must be especially sensitive to their particular audience, introducing them to oral presentations in which they must communicate information to an audience using a variety of presentational media. Electronic skills are taught to complement the written and oral skills by enabling students to use state-of-the-art internet and database search techniques to locate the information they require to produce written reports or presentations. Students must also maintain a portfolio (including a reflective journal) exhibiting their efforts, progress, and achievement throughout the course.

Prerequisite: ENGL 101

- **CS 101 Computer Programming I Credits and contact hours: 4 (3,0,3)**

Overview of computers and computing. Introduction to a typical programming language, such as Java. Basic data types and operators. Basic object-oriented concepts. Wrapper classes. Console input/output. Logical expressions and control structures. Memory models and methods. Arrays and strings. More object-oriented concepts.

Suggested Lab work (Closed Lab): Programming assignments to exercise the use of the various features of the object-oriented programming language taught in the course. This may include the implementation of basic applets, numerical algorithms such as finding the average, standard deviation, etc., and non-numerical algorithms such as basic recursive methods used in sorting and searching techniques.

Co-requisite: MATH 101

- **IE 199 Introduction to Engineering and Design Credits and contact hours: 3 (2,1,3)**

Engineering profession, jobs, and disciplines; Elements of engineering analysis; Introduction to engineering design and team formation; Engineering problem definition; Engineering system Architecture and physical function decomposition; human factor, environment, and safety issues in design; Generation of alternative concepts; Evaluation of alternatives and selection of a concept, Design defense, performance evaluation, and reporting; Intellectual Property – Legal Factors, Engineering Ethics.

Prerequisite: None

- **IAS 212 Professional Ethics Credits and contact hours: 2 (2,0,0)**

Importance of ethics in Islam and the integration of worship and aspects of professional life. Suitability criteria for employment in Islam. Standards for professional behavior. Employee interaction with others. Application of Islam to professional violations. Saudi Laws and professional behavior.

Prerequisite: IAS 111

- **MATH 260 Linear Algebra and Differential Equations Credits and contact hours:3 (3,1,0)**

Systems of linear equations. The rank of matrices. Eigenvalues and eigenvectors. Vector spaces, subspaces, bases, dimensions. Invertible matrices. Similar matrices. Diagonalizable matrices. Block diagonal and Jordan forms. First order differential equations: separable and exact. The homogeneous differential equations with constant coefficients. Wronskian. Non-homogeneous differential equations. Methods of undetermined coefficients and variation of parameters. Systems of differential equations. Non-homogeneous systems.

Prerequisite: MATH 102

COE 202 Digital Logic Design Credits and contact hours:3 (3,0,0)

Introduction to information representation and number systems. Boolean algebra and switching theory. Manipulation and minimization of completely and incompletely specified Boolean functions. Physical properties of gates: fan-in, fan-out, propagation delay, timing diagrams, and tri-state drivers. Introduction to hardware description languages (HDLs). VHDL. System modeling using VHDL. Combinational circuit analysis and design, multiplexers, decoders, comparators, and adders. Sequential circuit analysis and design, basic flip-flops, clocking, and timing diagrams. Registers, counters, RAMs, ROMs, PLAs, PLDs, and FPGAs.

Prerequisite: PHYS 102

Co-requisites: COE 203

- **COE 203 Digital Logic Design Lab Credits and contact hours:1 (0,0,1)**

Review of Digital Logic Design: Design of Combinational Circuits, and Design of Sequential Circuits. Logic implementation using discrete logic components (TTL, CMOS) and programmable logic devices. Introduction to Field Programmable Logic Arrays (FPGAs). The basic design flow: design capture (schematic capture, HDL design entry, design verification, and test, implementation (including some of its practical aspects), and debugging. Design of data path and control unit.

Prerequisite: PHYS 102

Co-requisites: COE 202

- **CS 102 Computer Programming II Credits and contact hours:4 (3,1,3)**

This course continues the coverage of the fundamental concepts of Object-Oriented Programming started in Programming I (CS 101). It covers more advanced concepts and topics such as relationships between classes, inheritance, polymorphism, abstract classes, error handling, interfaces, generics, and data structures.

Prerequisite: CS-101

- **CS 285 Discrete Math for Computer Credits and contact hours: 3 (3,1,0)**

Topics covered in this course include The Foundations: Logic and Proof, Sets, and Functions, Logic, Propositional Equivalences, Predicates and Quantifiers, Nested Quantifiers, Methods of Proof, Sets, Set Operations, and Functions. The Fundamentals: Algorithms, the Integers, and Matrices, Algorithms, Growth of Functions, Complexity of Algorithms, Integers and Division, Applications of Number Theory, Matrices. Mathematical Reasoning, Induction, and Recursion: Proof Strategy, Sequences and Summations, Mathematical Induction, Recursive Definitions, and Structural Induction, Program Correctness. Counting: The Basics of Counting, Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients Inclusion-Exclusion, Applications of Inclusion-Exclusion. Discrete Probability. Relations: Relations and Their Properties, Binary Relations and Their Applications Representing Relations,

Equivalence Relations. Graphs: Introduction to Graphs, Graph Terminology, Representing Graphs and Graph Isomorphism, Connectivity. Trees: Introduction to Trees, Applications of Trees, Tree Traversal, Spanning Trees. Boolean algebra: Boolean Functions, Representing Boolean Functions, Logic Gates. Modeling Computation: Languages and Grammars. The lab session to problem-solving using software

Pre-requisites: MATH 102

- **EE 202 - Electric Circuits I Credits and contact hours 3 (3,1,0)**

Circuit theorems: Superposition principle, Thevenin and Norton theorems, Maximum power transfer theorem. Techniques of circuit analysis: Nodal and mesh analysis, Sinusoidal sources, and the concept of phasors in circuit analysis. Introduction to average, reactive, complex power, and power factor. Introduction to three-phase circuits.

Pre-requisite: Math 102, Phys 102

- **COE 204 Computer Organization Credits and contact hours: 3 (3,0,0)**

Introduction to computer organization, machine instructions, addressing modes, assembly language programming, integer and floating-point arithmetic, CPU performance and metrics, non-pipelined and pipelined processor design, datapath and control unit, pipeline hazards, memory system, and cache memory.

Pre-requisite: COE 202

- **COE 205 Computer Organization Lab Credits and contact hours: 1 (0,0,3)**

MIPS Assembly Programming: Integer Arithmetic and Logic instructions, Flow Control instructions, Arrays and Files, Integer Multiplication and Division, MIPS Functions and the Stack Segment, Exceptions and I/O, Floating-Point representation. Modeling and designing using Logisim (Logic Simulator): Data Path Main Components Design (ALU design), Single-Cycle CPU Design, Pipelined CPU Design.

Pre-requisite: COE 202

- **CS-210: Data Structures and Algorithms Credits and contact hours: 3 (3,1,0)**

Fundamental concepts of data structures. Performance measurement of algorithms. Implementation and use lists, stacks, queues, priority queues, trees, heaps, hash tables, and graphs. Recursion. Students will do programming assignments.

Prerequisite: CS-102

- **EE 206 - Electric Laboratory I Credits and contact hours: 1 (0,0,3)**

General introduction to the laboratory. Ohms law, Voltage, current, and power in DC circuits using Kirchoff's laws. Superposition, Thevenin's, and Maximum power

transfer theorems in DC circuits; Series and parallel AC circuits; Resonance in series and parallel circuit; The Oscilloscope and Function Generator, Sinusoidal AC Analysis Maximum power transfer theorem, Magnetically-coupled circuits; Electric Field and Potential Inside Capacitors. Capacitance and Inductance of Transmission Lines.

Co-requisite: EE 202

- **EE 220- Electronics I Credits and contact hours: 3 (3,1,0)**

Introduction to semiconductor material properties; Semiconductor diodes: structure, Operation and circuit applications; Special diodes: Zener, LED, Solar cell and photodiode; Metal Oxide Field Effect Transistors (MOSFETs): Structure, operation, and Circuit applications; Bipolar Junction Transistor (BJT): Structure operation, and circuit applications. Thyristors: Structure and I-V characteristics.

Pre-requisite: Phys 102

- **EE 270 - Signal and System Analysis Credits and contact hours: 3 (3,1,0)**

Motivation and applications, Signal classifications, Signal operations, Singularity functions; Linear time-invariant systems and convolution; Correlation; Fourier series and transform for continuous and discrete time signals; Frequency response; Laplace transform and applications.

Pre-requisite: EE 202

- **ENGL 214 Academic & Professional Communication Credits and contact hours: 3 (3,0,0)**

This course aims to further develop students' spoken and written communication skills in English to prepare them for future academic and professional life. The writing skills component includes training in composing various types of business correspondence to enable students to function well in work. It also deals with researching, organizing, and writing technical reports in which students must be especially sensitive to their particular audience. The course's oral presentation component enhances students' oral presentation skills as they will practice communicating a technical subject to a lay audience using various presentational media. The electronic skills taught are intended to complement the written and oral skills by enabling students to use state-of-the-art internet and database search techniques to locate the information they require to produce written reports or presentations. Students must also maintain a portfolio (including a reflective journal) exhibiting their efforts, progress, and achievement throughout the course.

Prerequisite: ENGL 102

- **COE 304 - Introduction to Embedded Systems Credits and contact hours: 4 (3,0,3)**

Introduction to Embedded Systems. Microcontroller Hardware. ARM Processor. CPU Programming. Memory and I/O. Interfacing: Parallel and Serial Communication. A/D and D/A conversion Embedded system design methodologies. Specifications. Designing robust software for embedded systems. RTOS features.

Pre-requisite: COE 204, CS 102

- **COE 342 - Data & Computer Communication Credits and contact hours: 4 (3,0,3)**

Introduction to communication systems; Network architecture and the OSI reference model; Data transmission principles: time and frequency representation of signals, channel bandwidth, data rate, transmission Impairments, channel capacity, Transmission media; Data encoding and modulation techniques; Digital data communication techniques; framing and synchronization, error detection, error correction; Data Link Control protocols: Flow control, Error control and ARQ, Multiplexing techniques; Example Data Link protocols.

Pre-requisite: COE 204, EE 270

- **CS 225 - Software Engineering Design and Development Credits and contact hours: 3 (3,1,0)**

This is a general course, presenting the basic principles and concepts of software engineering and giving the foundation for many other courses. It gives broad coverage of the most important terminology and concepts in software engineering: basic understanding of software life cycle, software processes, requirements engineering processes, introduction to agile and extreme programming, basic modeling and design, basics of project management, software cost estimation, configuration management, and testing, introduction to ethics and professional practice in software engineering.

Pre-requisite: CS 102

- **EE 221 – Electronics Laboratory I Credits and contact hours: 1 (0,0,3)**

Introduction to the lab tools, I-V characteristics of the diode, clipping circuits using diodes, rectification using diodes, Zener diode and regulators, BJT DC biasing, CE BJT amplifier. MOSFET DC biasing, CS MOSFET amplifier, Simulation of Simple Circuits.

Co-requisite: EE 220

- **EE 370 - Digital Signal Processing Credits and contact hours: 3 (3,1,0)**

Characterization and classification of discrete-time (DT) signals and systems; Typical DT signal processing operations; Linear time-invariant (LTI) - DT systems; Linear constant-coefficient difference equations; Frequency-domain representation of discrete-time signals and systems; Discrete Fourier Transform (DFT); Fast Fourier

transform (FFT); Z-transform; Linear phase transfer functions; Digital filter structures; Finite-Impulse Response (FIR) Digital Filter Design; Infinite-Impulse Response (IIR) Digital filter design; Digital processing of continuous-time signals; Fundamentals of multirate digital signal processing; Applications.

Pre-requisite: EE 270

- **IAS 311 Islamic Shariah Credits and contact hours: 2 (2,0,0)**

This course is important for the student to act well in like. The course includes: (i) Good manners in the life of Muslims in general; (ii) The state of Arabs before Islam in terms of marriage, divorce, and inheritance; (iii) The merits and characteristics of Islamic Sharia; (iv) A short study of the four Islamic jurisprudence schools, and (v) A short study of Islamic jurisprudence branches.

Prerequisite: IAS 111

- **COE 344 Computer Networks Credits and contact hours: 4 (3,0,3)**

Introduction to computer networks: Internet architectures, Circuit-switching and Packet switching, Delay and loss, Protocol architectures and reference models; Application layer: Design issues, Client-server vs. peer-to-peer, main Internet protocols (HTTP, FTP, Email, DNS, and P2P), Network Sockets; Transport layer: Multiplexing/Demultiplexing applications, UDP, Reliable data transfer, TCP, Congestion control mechanisms. Network layer: Virtual circuits vs. Datagram networks, routing, IP addressing and forwarding, Routing algorithms, Routing in the Internet; Link layer: Multiple Access protocols, Switched LANs, Link-layer addressing and ARP, Link-layer switches; Wireless LANs: 802.11 architecture, 802.11 MAC protocols.

Prerequisite: COE 342

- **COE 308 Computer Architecture Credits and contact hours: 3 (3,0,0)**

Fundamentals of computer design, power, cost, performance, instruction set principles, instruction and arithmetic pipelines, dynamic and speculative execution, precise exception, memory hierarchy, multilevel caches, virtual memory, multicores, multiprocessors, new trends in computer architecture.

Prerequisite: COE 204

- **CS 311 Design and Analysis of Algorithms Credits and contact hours: 3 (3,1,0)**

The course aims at answering two questions: what can be computed by a machine? And how efficiently? It starts by presenting machine models, then addresses the computability problem, and then the complexity of algorithms and their classification according to it.

Prerequisite: CS 102

- **CS 330 Operating Systems Credits and contact hours: 4 (3,1,3)**

The course explores the evolution, services, and structures of operating systems. It covers the basic concepts of operating system design and implementation and management of system resources such as Central Processing Unit (CPU), Input/output (I/O) devices, memory, and software. Examples from modern operating systems such as Unix and Windows-driven operating systems are scrutinized. The course features practical hands-on exercises in implementing and testing small multi-programmed operating systems.

Prerequisite: CS 210

- **IE 332 Engineering Economy Credits and contact hours: 3 (3,1,0)**

Cost concepts; Time value of money operations; Measuring the worth of investments; Comparison of alternatives; Depreciation; Economic analysis of public projects; Inflation, Breakeven analysis; Manufacturing costing.

Prerequisite: MATH 102

- **COE 402 Advanced Digital Systems Design Credits and contact hours: 3 (3,0,0)**

Review of sequential circuits design and analysis; Data path and control unit design; Design with Hardware Description languages (HDL); Design with Field-Programmable Gate Arrays (FPGAs); Block interfacing and high-level-synthesis.

Prerequisite: COE 204

- **COE 455 Introduction to Digital Control Credits and contact hours: 3 (3,0,0)**

Continuous Systems: Review of mathematical representation of systems (transfer functions) modeling and parameter identification, system analysis in the time domain, system stability, steady state error, root locus, and compensator design using pole placement and root locus. Discrete Systems: System modeling and parametric identification; Difference equations; review of Z transform; Review of sampling and reconstruction; Stability analysis; steady-state error; Root Locus; Design of discrete-time control systems.

Prerequisite: EE 370

- **COE 460 Principles of VLSI Design Credits and contact hours: 3 (3,0,0)**

Large-scale MOS design: MOS transistors, static and dynamic MOS gates, stick diagrams, programmable logic array design, MOS circuit fabrication, design rules, resistance and capacitance extraction, power and delay estimates, scaling, MOS combinational and sequential logic design, register and clocking schemes, memory, datapath, and control unit design. Elements of computer-aided circuit analysis and layout techniques.

Prerequisite: EE 220

- **COE 498 Design Project-I Credits and contact hours: 3 (3,0,0)**

The student should take a B.Sc. project in a related area to his specialization and with technical merit. The projects are oriented toward providing experience in the establishment of objectives, criteria, synthesis, analysis, construction, testing, and evaluation; solution of open-ended problems; design methodology. This project is for two semesters; it is counted as three credits for the first semester. At the end of the semester, the student submits a report describing his projects and the parts he completed in the first semester and proposed parts in the 2nd semester.

Prerequisite: EE 220

- **IE 412 Project Management Credits and contact hours: 3 (3,1,0)**

The course covers the project management process from the beginning to the end, focusing on practical skills that enable students to immediately complete projects on time and within budget while achieving their targets; Project Participants and Project Life Cycle. Contractual and organizational approaches; Projects Planning Processes and Bar Chart; Network Model; Scheduling using activity-on-node, precedence methods, and time Scaled.; Resource leveling and allocation; Project time-cost trade-off; Financial Management: Cash flow Forecasting; Project time and cost control; Analysis of Scheduling Delay; Project risk analysis.

Prerequisite: MATH 201

- **COE 499 Design Project-II Credits and contact hours: 3 (3,0,0)**

The student should take a B.Sc. project in a related area to his specialization and with technical merit. The projects are oriented toward providing experience in establishing objectives, criteria, synthesis, analysis, construction, testing, and evaluation; solution of open-ended problems; design methodology. This project is for two semesters; it is counted as three credits for the first semester. At the end of the semester, the student submits a report describing his projects and the parts he completed during the semester.

Prerequisite: COE 498

- **COE 4xx COE Elective I Credits and contact hours: 3 (3,0,0)**

Computer Engineering Elective Course

- **COE 4xx COE Elective II Credits and contact hours: 3 (3,0,0)**

Computer Engineering Elective Course

- **EE/CS/COE xxx: Technical Elective Credits and contact hours: 3 (3,0,0)**

Technical Elective Course

- **IAS 4xx IAS Elective Credits and contact hours:2 (2,0,0)**

Islamic Elective Course

- **COE 444 Internetwork Design & Management Credits and contact hours: 3 (3,0,0)**

Principles of internetworking. Internetworking hardware. Bridging and switching technologies. Virtual LANs. Routing strategies. The network development life cycle. Network analysis and design methodology. Enterprise network design model. Backbone design concepts. Network security design. Structured cabling systems. Network design algorithms. Traffic flow analysis. Network reliability. Network management (SNMP). Network administration. Case studies.

Prerequisite: COE 344

- **COE 446 Computer & Network Security Credits and contact hours: 3 (3,0,0)**

Introduction to computer security: concepts, threats, type of attacks; Cryptography: Block ciphers, Public-Key, Cryptographic Protocols and standards. Integrity verification mechanisms, Authentication: Hash functions, User authentication Protocols, Wireless network security and associated protocols. Software tools to apply security in user environments. Access Control models and mechanisms. Database security, Intrusion detection systems, Firewalls. Malicious software, DoS attacks, Trusted computing and multilevel security.

Prerequisite: COE 344

- **COE 448 Wireless & Mobile Networks Credits and contact hours: 3 (3,0,0)**

Introduction to Wireless and Mobile Networks: Fundamental concepts in mobile wireless networks, Characteristics of wireless links, RF propagation, path loss models; Fixed assignment Multiple access techniques: FDMA/TDMA/CDMA, Performance of Fixed assignment techniques, Erlang-B model; The cellular concept: frequency reuse, cell architecture and handoff protocols; Cellular Technologies: 2G/GSM, 3G/UMTS/HSPA, 4G/LTE/LTE-A; Wireless LANs: multiple access techniques for LANs, IEEE 802.11 (WiFi); Mobility management: Mobile IP protocol.

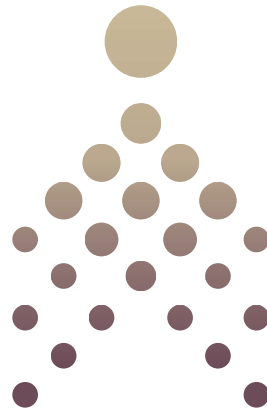
Prerequisite: COE 344

- **COE 4xx Computer Networks Elective I Credits and contact hours: 3 (3,0,0)**

Computer Networks Elective Course

- **COE 4xx Computer Networks Elective II Credits and contact hours: 3 (3,0,0)**

Computer Networks Elective Course



جامعة المستقبل

كلية الهندسة وعلوم الحاسب

COMPUTER ENGINEERING PROGRAM
Program Manual
2022