



**Jordan University of Science and Technology**  
**Faculty of Computer and Information Technology**  
**Department of Computer Engineering**

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**Study Plan of Bachelor Degree in Computer Engineering**

**2016**

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**Vision:**

The Department of Computer Engineering strives to continue to be the premier department for computer engineering in Jordan and to become internationally recognized for excellent education for students while contributing to national economy through research and transfer to industry.

**Mission:**

The mission of the Department of Computer Engineering is to produce best quality Computer Engineering Professionals by offering a broad-based education, encouraging life-long learning, fostering teamwork and leadership and promoting creativity and competitiveness. Furthermore, pursue creative research and new technologies in Computer Engineering and across disciplines in order to serve the needs of industry and society.

**Objectives:**

The Computer Engineering B.Sc. program has the following program educational objectives:

- 1- Demonstrate technical ability in local, regional, and global computer engineering workforce including software and hardware careers.
- 2- Engage in lifelong learning, establish professional and transferable skills that result in being competent in a world of evolving technology, and pursue higher degrees in different fields of computer engineering.
- 3- Become a productive member of society who is able to undertake leadership roles and make sound engineering decisions in order to contribute to the economic growth.

**Outcomes**

The Students Outcomes of the bachelor program of Computer Engineering are:

1. An ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
2. An ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors

3. An ability to communicate effectively with a range of audiences
4. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
5. An ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
6. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
7. An ability to acquire and apply new knowledge as needed, using appropriate learning strategies

## Study Plan of Bachelor degree in computer engineering (2015 - 2016)

### Numbering and coding system of courses of the study plan.

#### Course Coding

The following codes are used to designate courses:

Department			Level/year	Field	Sequence
A	B	C	x	y	z

The Department codes (A, B, C) are as follows:

Code	Department
CPE	Computer Engineering
NES	Network Engineering and Security
CS	Computer Science
CIS	Computer Information Systems
SE	Software Engineering

#### Course Numbering

- The computer engineering courses are tabled and numbered in such a manner to recognize each course regarding its subject area, year or level, and semester offered.

**Example: cpe xyz:** The **cpe** symbol in the course number denotes computer engineering (xyz) is a 3-digits number:

A. The first digit denotes the year level of the course according to student's study plan as follows:

Code	Level/year
1	First
2	Second
3	Third
4	Fourth
5	Fifth

B. The second digit denotes the course field subject as follows:

Number	Specialization
0	General
1	Programming
2	Electronics
3	Digital Systems
4	Secure and Reliable Computing
5	Architecture
6	Networking
7	Systems Programming
8	Artificial Systems
9	Graduation projects, training, and special topics

C. The third digit denotes sequence of semester during which the course is offered according to the study plan. In way that odd numbers are given to the first and summer semesters while even numbers are given to second semesters.

**Example:** CPE 421 (Digital Integrated Circuits) means:

CPE	4	2	1
computer engineering	Level (Fourth year)	Field (Electronics)	Sequence (First semester)

A Bachelor of Science (B.Sc.) degree in computer engineering at JUST is awarded in accordance with the statute stated by JUST regulations for B.Sc. awarding issued by the Dean's Council based on the adjusted 1987 law for awarding scientific degrees and certifications at JUST after completing (160) credit hours successfully.

The study plan composed of the following:

**Table 1: Credit Hours Distribution for Computer Engineering**

Classification	Credit hours		
	Compulsory	Elective	Total
University requirement	16	9	25
Faculty requirement	27	0	27
Department requirement	93	15	108
<b>Total</b>	<b>136</b>	<b>24</b>	<b>160</b>

**1. University Requirements (25 CHs):****1-a) University Mandatory Courses (16 CHs):**

Course Number	Course Title	Credit Hours	Weekly Hours	
			Lecture	Lab
ARB 101	Arabic Language	3	3	0
HSS 110	Social Responsibility	3	3	0
HSS 119	Entrepreneurship and Innovation	2	2	0
ENG 112 (1)	English Language II	3	3	0
HSS 129	General Skills	2	2	0
MS 100 (2)	Military Science	3	3	0

NOTE: Non-Arabic speaking students register for the following course instead of (ARB 101):

Course Number	Course Title	Credit Hours	Weekly Hours	
			Lecture	Lab
ARB 101A	Fundamentals of Arabic language for Non-Arabs	3	3	0

**1-b) University Elective Courses (9 CHs):**

<sup>1</sup>- Prerequisite: (ENG 111) or pass the prelim English exam with no less than 80%.

<sup>2</sup>- The grade for this course is a Pass/Fail grade. Non-Jordanian students can take a substitute course from the elective courses, and the grade for the elective course goes into the calculation of the grade point average.

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
NUR 100	Health Promotion (For Non Nursing & Midwifery Students)	3	3	0	-
NF 177	Food Preservation (For Non Nutrition & Food Technology Students) (in English)	3	3	0	-
ADS 100	Oral & Dental Health (For Non Dentistry & Allied Dental Sciences Students)	3	3	0	-
PHAR 104	Drugs and Medicinal Plants: Uses and Side Effect (For Non-Medicine and Pharmacy Students)	3	3	0	-
PH 104	Human Health and Nutrition (For Non-Medicine and Nursing Students)	3	3	0	-
PH 200	First Aid and Emergency Procedures (For Non-Medicine, Pharmacy and Nursing Students)	3	3	0	-
VM 211	Animal Health (For Non-Veterinary Medicine and Agriculture Students)	3	3	0	-
VM 212	Pet Animals Care (For Non-Veterinary Medicine Students)	3	3	0	-
HSS 112	Hadith Shareef	3	3	0	-
HSS 113	Aqideh	3	3	0	-
HSS 114	Fiqeh	3	3	0	-
HSS 115	Islam & Contemporary Problems	3	3	0	-
HSS 116	Islamic Economic System	3	3	0	-
HSS 121	Principles of Sociology (For Non-English Language Students)	3	3	0	-
HSS 126	Principles of Psychology (For Non Nursing & Midwifery Students)	3	3	0	-
HSS 127	Education Technology	3	3	0	-
HSS 128	National Education	3	3	0	-
HSS 131	Islamic Civilization	3	3	0	-
HSS 132	The History of the City of Jerusalem	3	3	0	-
HSS 133	Civilization and Recent Cultures	3	3	0	-
HSS 141	Principles of Economics (For Non-Computer and Information Systems Students)	3	3	0	-
HSS 142	Library and Information Research	3	3	0	-
HSS 151	Principles of Management (For Non-Computer and Information Systems Students)	3	3	0	-
HSS 161	Contemporary Problems	3	3	0	-
HSS 166	Man and Science	3	3	0	-
HSS 182	Woman Studies	3	3	0	-
HSS 211	Introduction to Sociology (in English)	3	3	0	-
HSS 212	Arab Society (in English)	3	3	0	-
HSS 213	The Individual and Society (in English)	3	3	0	-
HSS 216	Contemporary International Issues (in English)	3	3	0	-
HSS 221	Introduction to Psychology (For Non Nursing & Midwifery Students) (in English)	3	3	0	-
HSS 222	Creativity and Problem Solving	3	3	0	-



HSS 224	Leadership and Communication Skills	3	3	0	-
HSS 231	History of Sciences in the Arab World	3	3	0	-
HSS 241	Economy in the Third World	3	3	0	-
HSS 242	Information and Research (in English)	3	3	0	-
HSS 250	The History of Music (in English)	3	3	0	-
HSS 429	The Science of Children Behavior and Treatment	3	3	0	-
AP 200	Farm Animal Products and Production (For Non Agriculture And Veterinary Students)	3	3	0	-
PT 100	Wellness & Lifestyle (For Non Physical & Occupational Therapy Students)	3	3	0	-
ES 103	Environment Protection (For Non Environmental Sciences Students)	3	3	0	-
ME 211	Fundamentals of Automobile Engineering (For Non-Mechanical Engineering Students)	3	3	0	-
NR 200	Natural Resources and Man (For Non Agriculture Students)			0	
PP 200	Home Gardens (For Non Agriculture Students)	3	3	0	-
PP 201	Bee Keeping (For Non Agriculture Students)	3	3	0	-

## 2. Faculty Requirements (27 CHs):

**Table 2: Mandatory Faculty Requirements**

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
MATH 101	Calculus I	3	3	0	-
MATH 102	Calculus II	3	3	0	MATH 101
MATH 241	Discrete Mathematics	3	3	0	-
CS 101	Introduction to Programming	3	3	0	CIS 100 or Concurrent
CS 102	Programming Lab	1	0	3	CS 101 or Concurrent
CS 112	Introduction to Object-Oriented Programming	3	3	0	Passing CS 102
CS 113	Object-Oriented Programming Lab	1	0	3	CS 112 or Concurrent
CS 211	Data Structures	3	3	0	MATH 241+ Passing CS 112
CIS 200	Professional & Ethical Issues in Computing	1	1	0	-
CIS 201	Introduction to Web Design	1	0	3	CS 113
CIS 202	Communication Skills	2	2	0	CIS 200 or concurrent
CIS 221	Fundamentals of Database Systems	3	3	0	CS 211

**3. Department Requirements (108 CHs):****3-a) Department Mandatory Courses from other Departments (49 CHs):****3-a1) Mandatory Courses from the Department of Network Engineering and Security (10 CHs):**

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
NES 301	Probability and Queuing Theory	3	3	0	MATH 241
NES 311	Data Communication	3	3	0	CPE 231 + EE 260 or Concurrent
NES 312	Fundamentals of Computer Networks	3	3	0	NES 301 + NES311
NES 413	Computer Networks Laboratory	1	0	3	NES 312

**3-a2) Mandatory Courses from the Department of Electrical Engineering (14 CHs):**

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
EE 212	Electrical Circuits Analysis	3	3	0	PHY 102 + MATH 203 or Concurrent
EE 213	Electrical Circuits Lab	1	0	3	EE 212
EE 260	Signals and Systems Analysis	3	3	0	EE 212 + CS 181
EE 321	Fundamentals of Electronics ( <i>Non EE Students</i> )	3	3	0	EE 212
EE 322	Electronics Circuits Lab	1	0	3	EE 213 + EE 321
EE 440	Control Systems	3	3	0	EE 260

**3-a3) Mandatory Courses from the Department of Mechanical Engineering (3 CHs):**

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
ME 215	Engineering Mechanics	3	3	0	PHY 101

**3-a4) Mandatory Courses from the Department of Mathematics (6 CHs):**

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
MATH 201	Intermediate Analysis	3	3	0	MATH 102
MATH 203	Ordinary Differential Equations "1"	3	3	0	MATH 102

**3-a5) Mandatory Courses from the Department of Applied Physics (7 CHs):**

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
PHY 101	General Physics I	3	3	0	-
PHY 107	General Physics (Lab)	1	0	3	PHY 101
PHY 102	General Physics II	3	3	0	PHY 101

**3-a6) Mandatory Courses from the Department of Applied Chemistry (3 CHs):**

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
CHEM 103	General Chemistry	3	3	0	-

**3-a7) Mandatory Courses from the Department of Software Engineering (3 CHs):**

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
SE440	Project Management	3	3	0	CPE 311

**3-a8) Mandatory Courses from the Department of Computer Science (3 CHs):**

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
CS 181	Linear Algebra	3	3	0	MATH 101

**3-b) Department Mandatory Courses from Department of Computer Engineering (44 CHs):**

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
CPE 200	Numerical Analysis	2	2	0	MATH 201 + MATH 203 + CS 113
CPE 211	Scripting Languages Lab	1	0	3	CS 113
CPE 231	Digital Logic Design	3	3	0	CS 113
CPE 232	Digital Logic Design Lab	1	0	3	CPE 231
CPE 252	Computer Organization and Design	3	3	0	CPE 231
CPE 300	Workshop in Computers Maintenance and Operation	1	0	3	CPE 232
CPE 311	Object-Oriented Software Design and Analysis	3	3	0	CS 113
CPE 351	Microprocessor Systems	3	3	0	CPE 252
CPE 352	Computer Architecture	3	3	0	CPE 252
CPE 354	Microprocessor Systems Lab	1	0	3	CPE232 + CPE 351
CPE 421	Digital Integrated Circuits	3	3	0	CPE 231 + EE 321
CPE 451	Introduction to Embedded Systems	3	3	0	CPE 311 + CPE 351
CPE 454	Interfacing Lab	1	0	3	CPE 451 + CPE 354
CPE 473	Operating Systems	3	3	0	CPE 352
CPE 480	Artificial Intelligence Systems	3	3	0	CPE 311 + NES 301
CPE 481	Introduction to Image Processing	3	3	0	CPE 311 + NES 301
CPE 491	Practical Training	3	-	0	Pass 120 hours
CPE 591	Graduation Project I	1	-	-	Pass 120 hours
CPE 592	Graduation Project II	3	-	-	CPE 591

**3-c) Department Elective Courses (15 CHs): (\*)**

- Student must select at least (9 CHs) from the Department Computer Engineering.
- Student may select at most (6 CHs) from other CIT departments.

(\*) Students who are trained in academy or professional training programs in the Faculty of Computer and Information Technology with at least 150 training hours and pass the corresponding international certification exam are exempted from (3 CHs) from other CIT departments.

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
CPE 510	Introduction to Algorithms and Parallel Programming	3	3	0	CPE 473
CPE 523	VLSI System Design	3	3	0	CPE 352 + CPE 421 + CPE 451
CPE 533	Advanced Digital Systems Design	3	3	0	CPE 352 + CPE 421 + CPE 451
CPE 551	Advanced Computer Architecture	3	3	0	CPE 352
CPE 554	Embedded Systems	3	3	0	CPE 454 + CPE 473
CPE 559	Computer Systems Project	3	3	0	SE 440 + CPE 473 + CPE 451
CPE 560	Distributed Systems and Middleware	3	3	0	CPE 473
CPE 579	Software Design and Development Project	3	3	0	SE 440 + CPE 311
CPE 581	Computer Vision	3	3	0	CPE 480 + CPE 481
CPE 584	Introduction to Neural and fuzzy computing	3	3	0	CPE 480 + NES 311
CPE 596	New Trends in Computer Engineering	3	3	0	Pass 110 hours + Department approval
CPE 597	Special Topics in Computer Engineering	3	3	0	Pass 110 hours + Department approval
NES 510	Network Simulation and Modeling	3	3	0	NES 413
CS 411	Mobile Applications Design and Development	3	3	0	CPE 311 + CS 211
CS 422	Information Retrieval Systems	3	3	0	CIS 221
CIS 421	Database Applications	3	3	0	CIS 221 + MATH 241
CIS 451	E-business	3	3	0	CIS 201
SE 431	Software Security	3	3	0	CPE 200 + CPE 311
SE 432	Software Engineering for Web Applications	3	3	0	CPE 311 + CIS 201

### Courses offered in the Computer Engineering Department for non-CPE students.

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite
			Lecture	Lab	
CPE 234	Digital Logic Design and Computer Architecture <sup>(1)</sup>	3	3	0	CIS 100
CPE 235	Digital Logic Design Lab <sup>(2)</sup>	1	0	3	CPE 234
CPE 353	Microprocessors Systems <sup>(3)</sup>	3	3	0	CPE 234
CPE 236	Digital Logic Design <sup>(4)</sup>	3	3	0	CIS 100
CPE 237	Digital Logic Design Lab <sup>(5)</sup>	1	0	3	CPE 236

<sup>(1)</sup> For non-IT students

<sup>(2)</sup> For non-IT students

<sup>(3)</sup> For non-IT students

<sup>(4)</sup> For IT students non-CPE and non-NES

<sup>(5)</sup> For IT students non-CPE and non-NES

## Study Plan

### FIRST YEAR

#### First Semester

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
MATH 101	Calculus I	3	3	0	-
CS 101	Introduction to Programming	3	3	0	Passing CIS 99
CS 102	Programming Lab	1	0	3	CS 101 or Concurrent
PHY 101	General Physics I	3	3	0	-
ENG 112	English Language II	3	3	0	Passing ENG 099
HSS 110	Social Responsibility	3	1	1	-
HSS 119	Entrepreneurship and Innovation	2	2	0	
<b>Total</b>		<b>18</b>	<b>16</b>	<b>4</b>	

#### Second Semester

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
MATH 102	Calculus II	3	3	0	MATH 101
CS 112	Introduction to Object-Oriented Programming	3	3	0	Pass CS 102
CS 113	Object-Oriented Programming Lab	1	0	3	CS112 or Concurrent
PHY 102	General Physics II	3	3	0	PHY 101
HSS 129	General Skills	2	2	0	-
ARB 101	Arabic Language	3	3	0	-
<b>Total</b>		<b>15</b>	<b>14</b>	<b>3</b>	

**SECOND YEAR****First Semester**

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
MATH 203	Ordinary Differential Equations "1"	3	3	0	MATH 102
MATH 201	Intermediate Analysis	3	3	0	MATH 102
CPE 211	Scripting Languages Lab	1	0	3	CS 113
MATH 241	Discrete Mathematics	3	3	0	-
CPE 231	Digital Logic Design	3	3	0	CS 113
PHY 107	General Physics (Lab)	1	0	3	PHY 101
CHEM 103	General Chemistry	3	3	0	-
<b>Total</b>		<b>17</b>	<b>15</b>	<b>6</b>	

**Second Semester**

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
CS 181	Linear Algebra	3	3	0	MATH 101
EE 212	Electrical Circuits Analysis	3	3	0	PHY 102 + MATH 203 or Concurrent
CIS 200	Professional & Ethical Issues in Computing	1	1	0	-
CIS 202	Communication Skills	2	2	0	CIS 200 or concurrent
CPE 200	Numerical Analysis	2	2	0	MATH 201+MATH 203 + CS 113
CPE 232	Digital Logic Design Lab	1	0	3	CPE 231
CPE 252	Computer Organization and Design	3	3	0	CPE 231
CS 211	Data Structures	3	3	0	Pass CS 112 + MATH 241
<b>Total</b>		<b>18</b>	<b>17</b>	<b>3</b>	

**THIRD YEAR****First Semester**

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
EE 260	Signals and Systems Analysis	3	3	0	EE 212 + CS 181
EE 213	Electrical Circuits Lab	1	0	3	EE 212
NES 301	Probability and Queuing Theory	3	3	0	MATH 241
NES 311	Data Communication	3	3	0	CPE 231 + EE 260 or Concurrent
CPE 311	Object-Oriented Software Design and Analysis	3	3	0	CS 113
CPE 351	Microprocessor Systems	3	3	0	CPE 252
CIS 201	Introduction to Web Design	1	0	3	CS 113
<b>Total</b>		<b>17</b>	<b>15</b>	<b>6</b>	

**Second Semester**

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
EE 321	Fundamentals of Electronics ( <i>Non EE Students</i> )	3	3	0	EE 212
CIS 221	Fundamentals of Database Systems	3	3	0	CS 211
NES 312	Fundamentals of Computer Networks	3	3	0	NES 311 + NES 301
ME 215	Engineering Mechanics	3	3	0	PHY 101
CPE 352	Computer Architecture	3	3	0	CPE 252
CPE 354	Microprocessor Systems Lab	1	0	3	CPE 232 + CPE 351
CPE 300	Workshop in Computers Maintenance and Operation	1	0	3	CPE 232
<b>Total</b>		<b>17</b>	<b>15</b>	<b>6</b>	



**FOURTH YEAR****First Semester**

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
CPE 473	Operating Systems	3	3	0	CPE 352
EE 322	Electronics Circuits Lab	1	0	3	EE 213 + EE 321
NES 413	Computer Networks Laboratory	1	0	3	NES 312
MS 100	Military Science	3	3	0	-
CPE 451	Introduction to Embedded Systems	3	3	0	CPE 311 + CPE 351
CPE 481	Introduction to Image Processing	3	3	0	CPE 311 + NES 301
CPE 421	Digital Integrated Circuits	3	3	0	CPE 231 + EE 321
<b>Total</b>		<b>17</b>	<b>15</b>	<b>6</b>	

**Second Semester**

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
EE 440	Control Systems	3	3	0	EE 260
CPE 480	Artificial Intelligence Systems	3	3	0	CPE 311 + NES 301
CPE 454	Interfacing Lab	1	0	3	CPE 451 + CPE 354
SE440	Project Management	3	3	0	CPE 311
-	University Elective Course	3	3	0	-
-	University Elective Course	3	3	0	-
<b>Total</b>		<b>16</b>	<b>15</b>	<b>3</b>	

**Summer Semester**

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
CPE 491	Practical Training	3	-	-	Pass 115 hours
<b>Total</b>		<b>3</b>	<b>-</b>	<b>-</b>	

## FIFTH YEAR

### First Semester

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
CPE 591	Graduation Project I (*)	1	-	-	Pass 115 hours
-	Department Elective Course	3	3	0	-
-	Department Elective Course	3	3	0	-
-	Department Elective Course	3	3	0	-
-	University Elective Course	3	3	0	-
<b>Total</b>		<b>13</b>	<b>12</b>	<b>0</b>	

### Second Semester

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
CPE 592	Graduation Project II	3	-	-	CPE 591
-	Department Elective Course	3	3	0	-
-	Department Elective Course	3	3	0	-
<b>Total</b>		<b>9</b>	<b>6</b>	<b>0</b>	

(\*)Students must register "CPE 591" before the graduation semester (Semester 1 or Semester 2).

## Courses Description

### **CPE 200: Numerical Analysis**

**(2C, 2H, 0L)**

*Prerequisite: MATH 201+MATH 203 + CS 113*

Basic skills of numerical methods such, Solving linear and non-linear equations and their systems numerically, numerical differentiation and integration, solving ordinary differential equations and their systems numerically, error calculations, curve fitting and interpolation. Students will be exposed to some special software related to numerical methods

### **CPE 211: Scripting Languages LAB**

**(1C, 0H, 3L)**

*Prerequisite: CS 113*

Programming using selected scripting languages.

### **CPE231: Digital Logic Design**

**(3C, 3H, 0L)**

*Prerequisite: CS 113*

Number systems; Boolean algebra and logic gates; simplification of Boolean functions; combinational logic analysis and design; design of combinational logic with SSI and MSI, hierarchical logic design; sequential logic analysis and design; registers, counters.

### **CPE 232: Digital Logic Design Lab**

**(1C, 0H, 3L)**

*Prerequisite: CPE 231*

Experiments in combinational and sequential logic based on the theory studied in CPE 231; Choice of projects: various sequential machines, D/A converters and CRT displays, integrators, arithmetic processors, stored-program processors and game-playing machines.

### **CPE 252: Computer Organization and Design**

**(3C, 3H, 0L)**

*Prerequisite: CPE 231*

Computer arithmetic circuits; PLDs; Floating point Numbers; Memories and Memory addressing; Instructions; Instruction sequencing and execution; RISC/CISC CPUs; Instruction format, Single Cycle and Multiple cycle CPUs, Hardwired control and Microprogrammed control; Assembly language and Assemblers; I/O organization; Interrupts; DMA; Buses;

**CPE 300: Workshop on Computer Maintenance and Operation** (1C, 0H, 3L)

*Prerequisite: CPE 232*

Overview of computer systems; PCs, laptops, servers, wired and wireless networks, printers, scanners, digital cameras, mobile devices and others; computer anatomy; motherboards and processors, memories, peripherals like mouse, keyboards, digital pads, and other pointing devices; computer assembly; operating systems, and compatibility and connectivity issues; human factors issues; ethics in computing.

**CPE 311: Object-Oriented Software Analysis and Design** (3C, 3H, 0L)

*Prerequisite: CS 113*

Software development processes, the Unified Modeling Language (UML), and object-oriented concepts such as data and program abstraction, decomposition of large systems into reusable objects, and inheritance encapsulation and polymorphism. Programming projects will be implemented in an object-oriented language such as JAVA and C#.

**CPE351: Microprocessor Systems** (3C, 3H, 0L)

*Prerequisite: CPE 252*

Microprocessor and microcontroller organization; assembly language and programming techniques; bus and memory organization; DMA; timing issues; interrupts; peripheral devices; serial and parallel communication; timing analysis; and interfacing to analog and digital systems.

**CPE352: Computer Architecture** (3C, 3H, 0L)

*Prerequisite: CPE 252*

Basic Processor Design; Performance Evaluation; Pipelining; Memory Hierarchies: Caches, Virtual memory; Input/output and Storage; Introduction to Instruction Level Parallelism.

**CPE354: Microprocessor Systems Lab** (1C, 0H, 3L)

*Prerequisite: CPE 232 + CPE 351*

Design, build, program, debug, document, and demonstrate a microprocessor-based system comprising CPU, RAM, EPROM, Programmable parallel interface, serial interface, and timer.

### **CPE421: Digital Integrated Circuits**

**(3C, 3H, 0L)**

*Prerequisite: EE 321 + CPE 231*

Analysis and design of CMOS digital integrated circuits, CMOS logic circuits, layout, and fabrication, MOS transistor theory, modeling MOS devices using equations and SPICE, voltage transfer characteristics, noise margins delay estimation, logical effort, electrical effort, CMOS logic circuits families: static CMOS logic, pseudo-nMOS logic, dynamic/domino logic, pass transistor logic. Latches and flip-flops, buffers and I/O circuits. Semiconductor memories: DRAM, SRAM, ROM, introducing VLSI concepts. A set of laboratory experiments will provide hands-on experience.

### **CPE451: Introduction to Embedded Systems**

**(3C, 3H, 0L)**

*Prerequisite: CPE 311 + CPE 351*

Microcontrollers; Special Purpose Processors; Field Programmable Gate Arrays; Embedded Systems Programming; Hardware Description Languages; Analog to digital and Digital to Analog Converters; Parallel and Serial interfacing.

### **CPE 454: Interfacing Lab**

**(1C, 0H, 3L)**

*Prerequisite: CPE 354 + CPE 451*

Design and implementation of several interfacing tasks; interfacing with simple I/O devices using latches, buffers, and parallel adapters; parallel and serial interfacing to printers, scanners, and CRTs. Timer programming (wave generation, frequency meters, and real time clocks); A/D and D/A converters and data acquisition; host-to-host communication through parallel and serial links and Modems; interfacing sound chips and control circuits.

### **CPE 473: Operating Systems**

**(3C, 3H, 0L)**

*Prerequisite: CPE 352*

Theories and implementation of modern operating systems including operating system interface (system calls), process and thread management, CPU and disk scheduling, synchronization, deadlock, memory management and virtual memory, file system, device management and I/O handling.

**CPE 480: Artificial Intelligence Systems****(3C, 3H, 0L)***Prerequisite: CPE 311 + NES 301*

Introduces representations, techniques, and architectures used to build applied systems and to account for intelligence from a computational point of view. Applications of rule chaining, heuristic search, constraint propagation, constrained search, inheritance, and other problem-solving paradigms. Applications of identification trees, neural nets, genetic algorithms, and other learning paradigms. Speculations on the contributions of human vision and language systems to human intelligence.

**CPE 481: Introduction To Image Processing****(3C, 3H, 0L)***Prerequisite: CPE 311 + NES 301*

Review of digital signal processing, image sampling and quantization, human visual system, color, point operations, morphological image processing, linear image filtering and correlation, frequency image transforms, noise reduction and restoration, image compression. Emphasis is on the general principles of image processing. Students learn to apply material by implementing image-processing algorithms in Matlab

**CPE491: Practical Training I****(3C, 3H, 0L)***Prerequisite: Completion of 110 CHs*

Eight weeks practical training in an institution that deals with information technology. Only institutions listed in the department are accepted. However, students who prefer to conduct the training in regional or international institutions are required to submit papers for acceptance, before they even start. At the end, students must submit a professional report that details the eight weeks activities.

**CPE591: Graduation Project I****(1C)***Prerequisite: Completion of 115 CHs*

The student should get familiar with the theoretical and practical aspects associated with the subject matter of the project.

**CPE 592: Graduation Project II****(3C)**

*Prerequisite: CPE 591*

The student implements, tests and presents the project proposed in graduation Project I course.

**CPE 510: Introduction to Parallel Algorithms and Programming** (3C, 3H, 0L)

*Prerequisite: CPE 473*

Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms.

**CPE 523: VLSI System Design** (3C, 3H, 0L)

*Prerequisite: CPE 352 + CPE 421 + CPE 451*

Review of CMOS logic design and fabrication, review of RTL description and HDL synthesis, design and analysis of sequential circuits, data path and functional units, memory array subsystems, I/O and clocking, layout design. Students will learn design methodologies and tools to be used in the implementation of the course experimental tasks.

**CPE533: Advanced Digital Systems Design** (3C, 3H, 0L)

*Prerequisite: CPE 352 + CPE 421 + CPE 451*

Advanced topics in combinational logic design: use of CAD, timing characteristics, system decomposition, arithmetic modules, PLD design, ALU design, and use of standard combinational modules. Introduction to HDL and its use in combinational logic design. FPGA. Advanced topics in sequential system design: using standard sequential modules, timing characteristics, effect of state code, modularization, design of complex sequential systems. Using HDL to describe sequential systems. Strategies and methods used in digital system design, Real-world digital design projects, Design for testability.

**CPE 551: Advanced Computer Architecture** (3C, 3H, 0L)

*Prerequisite: CPE 352*

This course will be a completely case-study based course. Topics include: the design principles and operation of state of the art architectures, qualitative and quantitative evaluation of computer systems, architectures based on Instruction-level parallelism (ILP) and

task-level parallelism, basics of ISA design, pipelining, VLIW architectures, super pipelined, superscalar, SIMD and MIMD architectures, out-of-order and speculative execution, branch prediction, data prediction, advanced memory hierarchies, multi-threading, exploiting task-level and instruction-level parallelism; input and output; network communication architecture. Starting with the basic architecture concepts and ending up with studying several case studies based on the latest commercial processors, embedded processors and academic processors.

### **CPE 554 : Embedded Systems**

**(3C, 3H, 0L)**

*Prerequisite: CPE 454 + CPE 473*

Definition, structure and properties of embedded systems, real-time programming: interrupts, latency, context, re-entrancy, thread and process models, microcontroller and DSP hardware structures, I/O systems, timing and event management, issues and concepts of hard and soft real-time systems, real- techniques for development, debugging and verification, limited resource environments, network embedded systems.

### **CPE 559: Computer Systems Project**

**(3C, 3H, 0L)**

*Prerequisite: SE 440 + CPE 451 + CPE 473*

Review of the important concepts in computer architecture, hardware implementation, operating systems, microprocessor, network architecture that are needed to carry out the tasks of the course project. Design of Instruction set architecture, design of data path and control, introduction to the design of special purpose architectures and embedded systems, simulation and performance analysis of a chosen case study, implementation and testing of the case study using hardware description language, hardware implementation and verification of the case study using CAD tools. The course may also include some operating system modules and/or network architecture components.

### **CPE 560: Distributed Systems and Middleware**

**(3C, 3H, 0L)**

*Prerequisite: CPE 473*

Fundamentals of distributed computing, software agents, naming services, distributed transactions, security management, distributed object-based systems, web-based systems, middleware-based application design and development, case studies of middleware and internet applications.

### **CPE579: Software Design and Development Project**

**(3C, 3H, 0L)**

*Prerequisite: SE 440 + CPE 311*



This course will expose students to the methods of developing large software systems in an industrial environment. Working in teams, students will design, implement, test, and document a complete software system in a specialized application domain. The work will include oral presentations and written reports.

**CPE 581: Computer Vision**

**(3C, 3H, 0L)**

*Prerequisite: CPE 480 + CPE 481*

Fundamental issues and techniques of computer vision, the goal is to develop methods that enable a machine to understand or analyze images and videos. Students will explore various fundamental topics in the area, including image formation, feature detection, segmentation, classification, recognition, learning and video processing. A set of projects will provide hands-on experience in related topics.

**CPE 584: Introduction to Neural and fuzzy computing**

**(3C, 3H, 0L)**

*Prerequisite: CPE 480 + NES 311*

Basic of fuzzy sets; fuzzy relations; fuzzy measures; fuzzy logic and approximate reasoning; applications of fuzzy systems in pattern recognition, control, and signal processing; overview of neuro-engineering technology; basic neural network architectures; feed forward and feedback networks; supervised and unsupervised learning; learning by punish/reward; temporal modeling; applications of neural networks in pattern recognition, control, and signal processing.

**CPE 596: New Trends in Computer Engineering**

**(3C, 3H, 0L)**

*Prerequisite: After completion of 110 CH + Department approval*

Selected new trends in computer and information technology.

**CPE 597: Special Topics in Computer Engineering**

**(3C, 3H, 0L)**

*Prerequisite: After completion of 110 CH + Department approval*

Selected state-of-the-art topics in computer and information technology.

**Courses offered in the Computer Engineering Department for non-CPE students.****CPE 234: Digital Logic Design and Computer Architecture (For non-IT students) (3C, 3H, 0L)**

*Prerequisite: CIS 100*

Numbering systems; logic design theory; basic logic components; combinational logic circuits; combinational logic practice; computer arithmetic units; sequential circuit basics; sequential circuits design; registers and register transfer; memory basics; ALUs; Computer I/O and serial communication.

**CPE 235: Digital Logic Design Lab (For non-IT students) (1C, 0H, 3L)**

*Prerequisite: CPE 234*

Experiments in combinational and sequential logic based on the theory studied in CPE 234; Choice of projects: various sequential machines, D/A converters and CRT displays, integrators, arithmetic processors, stored-program processors and game-playing machines.

**CPE 236: Digital Logic Design (For IT students non-CPE and non-NES) (3C, 3H, 0L)**

*Prerequisite: CIS 100*

Numbering systems; logic design theory; basic logic components; combinational logic circuits; combinational logic practice; sequential circuit basics.

**CPE 237: Digital Logic Design Lab (For IT students non-CPE and non-NES) (1C, 0H, 3L)**

*Prerequisite: CPE 236*

Experiments in combinational and sequential logic base on the theory studied in CPE 236.

**CPE 353: Microprocessors Systems (For non-IT students) (3C, 3H, 0L)**

*Prerequisite: CPE 234*

Microprocessor and microcontroller organization; assembly language and programming techniques; bus and memory organization; DMA; timing issues; interrupts; peripheral devices; serial and parallel communication; timing analysis; and interfacing to analog and digital systems.