Jordan University of Science and Technology

Faculty of Computer and Information Technology

Department of Computer Engineering

Study Plan of Bachelor Degree in Computer Engineering

2021

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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.

The Students 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 (2021)

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
CY	Cyber Security

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 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	24	0	24
Department requirement	96	15	111
Total	**136**	**24**	**160**

1.University Requirements (25 CHs):

1-a) University Compulsory Courses (16 CHs):

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

2. Faculty Requirements (24 CHs):

Table 2: Compulsory Faculty Requirements

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite	Teaching Mode
			Lecture	Lab		
MATH 101	Calculus (I)	3	3	0	-	FACE TO FACE
MATH 102	Calculus (II)	3	3	0	Passing MATH 101	FACE TO FACE
MATH 241	Discrete Mathematics	3	3	0	-	FACE TO FACE
CS 101	Introduction to Programming	3	2	0	CIS 99 or Concurrent	FACE TO FACE
SE 103	Introduction to Information Technology	3	3	0	Concurrent with CS 101	Online (Synchronous)
SE 112	Introduction to Object-Oriented Programming	3	2	0	Passing CS 101	Hybrid
CS 211	Data Structures	3	3	0	MATH 241+ passing SE 112	Hybrid
CIS 221	Fundamentals of Database Systems	3	3	0	CS 211	FACE TO FACE

3. Department Requirements (111 CHs):

3-a) Department Compulsory Courses from other Departments (52 CHs):

3-a1) Compulsory Courses from the Department of Network Engineering and Security (12 CHs):

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite	Teaching Mode
			Lecture	Lab		
NES 201	Communication Skills and Professional Ethics	2	2	0	-	Online (Synchronous)
NES 301	Probability and Queuing Theory	3	3	0	MATH 241	FACE TO FACE
NES 311	Data Communication	3	3	0	CPE 231 + EE 260 or Concurrent	FACE TO FACE
NES 312	Fundamentals of Computer Networks	3	3	0	NES 301 + NES311	FACE TO FACE
NES 413	Computer Networks Laboratory	1	0	3	NES 312	FACE TO FACE

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

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite	Teaching Mode
			Lecture	Lab		
EE 204	Introduction to Linear Systems	3	3	0	MATH 201	FACE TO FACE
EE 212	Electrical Circuits Analysis	3	3	0	PHY 102 + MATH 203 or Concurrent	FACE TO FACE
EE 213	Electrical Circuits Lab	1	0	3	EE 212	FACE TO FACE
EE 260	Signals and Systems Analysis	3	3	0	EE 212 + EE 204	FACE TO FACE
EE 321	Fundamentals of Electronics *(Non EE Students)*	3	3	0	EE 212	FACE TO FACE
EE 322	Electronics Circuits Lab	1	0	3	EE 213 + EE 321	FACE TO FACE
EE 440	Control Systems	3	3	0	EE 260	FACE TO FACE

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

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

3-a4) Compulsory Courses from the Department of Mathematics (8 CHs):

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite	Teaching Mode
			Lecture	Lab		
MATH 221	Numerical Analysis	2	2	0	MATH 201 + MATH 203	FACE TO FACE
MATH 201	Intermediate Analysis	3	3	0	Pass MATH 102	FACE TO FACE
MATH 203	Ordinary Differential Equations "1"	3	3	0	Pass MATH 102	FACE TO FACE

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

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite	Teaching Mode
			Lecture	Lab		
PHY 101	General Physics I	3	3	0	-	FACE TO FACE
PHY 107	General Physics (FOR NON-PHYSICS STUDENTS))	1	0	3	PHY 102 or concurrent	FACE TO FACE
PHY 102	General Physics II	3	3	0	Pass PHY 101	FACE TO FACE

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

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

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

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite	Teaching Mode
			Lecture	Lab		
SE440	Project Management	3	3	0	CPE 311	Online (Synchronous)

3-a8) Compulsory Courses from the Computer Information Systems (1 CHs):

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite	Teaching Mode
			Lecture	Lab		
CIS 201	Introduction to Web Design	1	0	3	SE 112	FACE TO FACE

3-b) Department Compulsory Courses from Department of Computer Engineering (42 CHs):

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite	Teaching Mode
			Lecture	Lab		
CPE 211	Scripting Languages Lab	1	0	3	SE 112	FACE TO FACE
CPE 231	Digital Logic Design	3	3	0	SE 112	FACE TO FACE
CPE 232	Digital Logic Design Lab	1	0	3	Pass CPE 231	Hybrid
CPE 252	Computer Organization and Design	3	3	0	CPE 231	FACE TO FACE
CPE 300	Workshop in Computers Maintenance and Operation	1	0	3	CPE 232	Hybrid
CPE 311	Object-Oriented Software Design and Analysis	3	3	0	SE 112	Hybrid
CPE 351	Microprocessor Systems	3	3	0	Pass 352 + Pass EE 321	Hybrid
CPE 352	Computer Architecture	3	3	0	Pass CPE 252	Hybrid
CPE 354	Microprocessor Systems Lab	1	0	3	Pass CPE232 + Pass CPE 351	FACE TO FACE

CPE 421	Digital Integrated Circuits	3	3	0	CPE 231 + EE 321	FACE TO FACE
CPE 451	Introduction to Embedded Systems	3	3	0	Pass CPE 351	FACE TO FACE
CPE 454	Interfacing Lab	1	0	3	CPE 451 + Pass CPE 354	FACE TO FACE
CPE 473	Operating Systems	3	3	0	CPE 352	Hybrid
CPE 480	Artificial Intelligence	3	3	0	CPE 311 + NES 301	FACE TO FACE
CPE 481	Introduction to Image Processing	3	3	0	CPE 311 + NES 301	Hybrid
CPE 491	Practical Training	3	-	0	Passing 115 hours	Hybrid
CPE 591	Graduation Project I	1	-	-	Passing 115 hours	Hybrid
CPE 592	Graduation Project II	3	-	-	CPE 591	Hybrid

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.

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite	Teaching Mode
			Lecture	Lab		
CPE 510	Introduction to Algorithms and Parallel Programming	3	3	0	CPE 473	Hybrid
CPE 523	VLSI System Design	3	3	0	CPE 352 + CPE 421 + CPE 451	Hybrid
CPE 533	Advanced Digital Systems Design	3	3	0	CPE 352 + CPE 421 + CPE 451	Hybrid
CPE 551	Advanced Computer Architecture	3	3	0	CPE 352	Hybrid
CPE 554	Embedded Systems	3	3	0	CPE 454 + CPE 473	Hybrid
CPE 559	Computer Systems Project	3	3	0	SE 440 + CPE 473 + CPE 451	Hybrid
CPE 560	Distributed Systems and Middleware	3	3	0	CPE 473	Hybrid
CPE 571	System Software Design	3	3	0	CPE 473	Hybrid
CPE 579	Software Design and Development Project	3	3	0	SE 440 + CPE 311	Hybrid
CPE 581	Computer Vision	3	3	0	CPE 480 + CPE 481	Hybrid
CPE 582	Machine Learning	3	3	0	CPE 480	Hybrid
CPE 584	Introduction to Neural and fuzzy computing	3	3	0	CPE 480 + NES 311	Hybrid

(*) 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 up to (6 CHs) from other CIT departments.

CPE 585	Cloud Computing	3	3	0	NES 312	Online (Synchronous)
CPE 586	Internet of Things and Smart Systems	3	3	0	CPE 454 + CPE 451	Hybrid
CPE 596	New Trends in Computer Engineering	3	3	0	Passing 110 hours + Department approval	Hybrid
CPE 597	Special Topics in Computer Engineering	3	3	0	Passing 110 hours + Department approval	Hybrid
NES 510	Network Simulation and Modeling	3	3	0	NES 413	FACE TO FACE
CS 411	Mobile Applications Design and Development	3	3	0	CPE 311 + CS 211	FACE TO FACE
CS 422	Information Retrieval Systems	3	3	0	CIS 221	Hybrid
CIS 421	Database Applications	3	3	0	CIS 221 + MATH 241	FACE TO FACE
CIS 451	E-business	3	3	0	CIS 201	FACE TO FACE
CY 431	Software Security	3	3	0	MATH 221 + CPE 311	Hybrid
SE 432	Software Engineering for Web Applications	3	3	0	CPE 311 + CIS 201	FACE TO FACE

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

Course Number	Course Title	Credit Hours	Weekly Hours		Prerequisite	Teaching Mode
			Lecture	Lab		
CPE236	Digital Logic Design [1]	3	3	0	CIS 099 pre/con	FACE TO FACE
CPE 231	Digital Logic Design [2]	3	3	0	SE 112	FACE TO FACE
CPE 232	Digital Logic Design Lab[2]	1	0	3	SE 112	Hybrid
CPE 252	Computer Organization and Design [2]	3	3	0	CPE 231	FACE TO FACE
CPE 300	Workshop in Computers Maintenance and Operation [2]	1	0	3	CPE 232	Hybrid
CPE 351	Microprocessor Systems [3]	3	3	0	CPE 252	Hybrid
CPE 353	Microprocessors Systems [4]	3	3	0	CPE 234	Hybrid
CPE 352	Computer Architecture [3]	3	3	0	CPE 252	Hybrid
CPE 354	Microprocessor Systems Lab [3]	1	0	3	CPE232 + CPE 351	FACE TO FACE
CPE 473	Operating Systems [3]	3	3	0	CPE 352	Hybrid

[1] For SE students
[2] For NES and CS students
[3] For NES students
[4] For non-IT students

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	2	0	Passing CIS 99 or Concurrent
PHY 101	General Physics I	3	3	0	-
LG 101	Communication Skills in English	3	3	0	Passing LG 099 or pass the level exam
SE 103	Introduction to Information Technology	3	3	0	Concurrent with CS 101
HSS 119	Entrepreneurship and Innovation	2	2	0	
Total		**17**	**16**	**2**	

Second Semester

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
MATH 102	Calculus II	3	3	0	MATH 101
HSS 110	Leader and Social Responsibility	3	2	1	-
SE 112	Introduction to Object-Oriented Programming	3	2	0	Passing CS 101
PHY 102	General Physics II	3	3	0	PHY 101
LG 103	LIFE Skills	2	2	0	-
ARB 102	Communication Skills in Arabic	3	3	0	-
Total		**17**	**15**	**3**	

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	SE 112
MATH 241	Discrete Mathematics	3	3	0	-
CPE 231	Digital Logic Design	3	3	0	SE 112
CIS 201	Introduction to Web Design	1	0	3	SE 112
PHY 107	General Physics (LAB)	1	0	3	PHY 102 or concurrent
CHEM 103	General Chemistry	3	3	0	-
Total		**18**	**15**	**9**	

Second Semester

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
EE 204	Introduction to Linear Systems	3	3	0	MATH 201
EE 212	Electrical Circuits Analysis	3	3	0	PHY 102 + MATH 203 or Concurrent
NES 201	Communication Skills, Professional and Ethical Issues	2	0	0	-
MATH 221	Numerical Analysis	2	2	0	MATH 201+MATH 203
CPE 232	Digital Logic Design Lab	1	0	3	Pass CPE 231
CPE 252	Computer Organization and Design	3	3	0	Pass CPE 231
CS 211	Data Structures	3	3	0	Pass CS 112 + MATH 241
Total		**17**	**14**	**3**	

THIRD YEAR

First Semester

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
EE 321	Fundamentals of Electronics *(Non EE Students)*	3	3	0	EE 212
EE 213	Electrical Circuits Lab	1	0	3	EE 212
NES 301	Probability and Queuing Theory	3	3	0	MATH 241
EE 260	Signals and Systems Analysis	3	3	0	EE 212 + EE 204
CPE 311	Object-Oriented Software Design and Analysis	3	3	0	SE 112
CPE 352	Computer Architecture	3	3	0	CPE 252 Passing
Total		**16**	**15**	**3**	

Second Semester

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
CIS 221	Fundamentals of Database Systems	3	3	0	CS 211
NES 312	Fundamentals of Computer Networks	3	3	0	NES 311 or Concurrent + NES 301
ME 215	Engineering Mechanics	3	3	0	PHY 101
NES 311	Data Communication	3	3	0	CPE 231 + EE 260 or Concurrent
CPE 351	Microprocessor Systems	3	3	0	CPE 352 Passing + EE 321 Passing
EE 322	Electronics Circuits Lab	1	0	3	EE 213 + EE 321
CPE 300	Workshop in Computers Maintenance and Operation	1	0	3	CPE 232
Total		**17**	**15**	**6**	

FOURTH YEAR

First Semester

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
CPE 473	Operating Systems	3	3	0	CPE 352
CPE 354	Microprocessor Systems Lab	1	0	3	CPE 232 Passing + CPE 351 Passing
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	Pass CPE 351
CPE 481	Introduction to Image Processing	3	3	0	NES 301
SE440	Project Management	3	3	0	CPE 311
Total		**17**	**15**	**6**	

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	NES 301
CPE 454	Interfacing Lab	1	0	3	CPE 451 + Pass CPE 354
CPE 421	Digital Integrated Circuits	3	3	0	CPE 231 + EE 321
-	University Elective Course	3	3	0	-
-	University Elective Course	3	3	0	-
Total		**16**	**15**	**3**	

Summer Semester

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
CPE 491	Practical Training	3	-	-	Passing 115 hours

Total	**3**	**-**	**-**	

FIFTH YEAR

First Semester

Course No.	Course name	Total credits	Weekly hours		Prerequisite
			Lecture	Lab	
CPE 591	Graduation Project I (*)	1	-	-	Passing 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	-
Total		**13**	**12**	**0**	

Second Semester

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

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

Courses Description

CPE 211: Scripting Languages LAB **(1C, 0H, 3L)**

Prerequisite: SE 112

Programming using selected scripting languages.

CPE231: Digital Logic Design **(3C, 3H, 0L)**

Prerequisite: SE 112

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 PASSING

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 PASSING

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: SE 112

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 352 PASSING + EE321 PASSING

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 PASSING

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 PASSING + CPE 351 PASSING

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 PASSING

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.

CpE 571: System Software Design (3C, 3H, 0L)

Prerequisite: CpE 473

This course is an introduction to designing and writing system software components such as operating systems, drivers, loaders, assemblers, linkers, compilers. Such software is low level and highly dependent on the hardware architecture. Therefore, students are expected to have good understanding of computer architecture. In addition to the concepts learned here, students will be asked to write different programs as part of multiple projects to apply what they learn.

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 582: Machine Learning (3C, 3H, 0L)

Prerequisite: CpE 480

This course is an introduction to machine learning covering supervised and unsupervised learning. Supervised learning will focus on regression problems and how algorithms, such as gradient descent, can be used for fitting models' parameters. The course then moves to multiple classification algorithms, such as logistic regression, support vector machines, K-nearest neighbor. Example algorithms on dimensionality reduction, such as principal component analysis, will also be discussed. Artificial neural networks and their use in applications such as, image processing and natural language processing will also be covered. In the unsupervised learning, the course will focus clustering. Throughout the course, students will write code to gain practice in applying the course concepts.

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.

CpE585: Cloud Computing (3C, 3H, 0L)

Prerequisite: NES312

This Course aims to introduce the students to the general structure of cloud computing. The course covers a wide range of topics, including: cloud computing applications and infrastructure, widely used distributed systems that makes up cloud infrastructure, cloud systems, cloud computing infrastructure delivery models: software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS), Cloud Types: General, Private, Mixed, Default. This is followed by a review of security and privacy issues related to cloud computing environments. A variety of real-world situations and tools will be identified and studied in order to provide students with a comprehensive view of cloud computing applications.

CpE586: Internet of Things and Smart Systems (3C, 3H, 0L)

Prerequisite: CpE 454 + CpE451

This Course aims to provide the students with the basic concepts of smart systems, models and techniques for building them and a comprehensive understanding of the Internet of Things. The course covers a wide range of topics, including: Introduction to the concepts of embedded systems and intelligent systems, sensor technologies, data transmission in smart systems, data processing, introduction and the fundamental concepts that support IoT, IoT protocols, IoT architecture, IoT applications and systems that support IoT, tools and components to build intelligent systems by using IoT concepts. The practical part of this course includes case studies and will integrate the acquired technologies to build intelligent systems for different applications systems such as smart cities, smart homes, smart health systems, security systems, and robots. The course should have an applicable project to build an intelligent system for specific field.

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

Prerequisite: -

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

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.

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Prerequisite: CpE 480

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