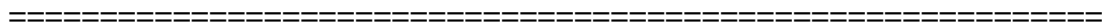# Yarmouk University

Faculty of Information Technology and Computer Sciences

Study Plan and Course Description for BSc in Computer Science

Department of Computer Sciences

2008/2009

Study Plan and Course Description
for BSc in Computer Science

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The degree in Bachelor of Computer Sciences/ Faculty of Information Technology and Computer Sciences is awarded after the completion of the following requirements:

1) The fulfillment of the conditions stated in the regulations for awarding the Bachelor Degree in Yarmouk Univ. No (2) in 1991 issued in accordance with bylaws for awarding scientific Degrees in Yarmouk Univ. No (118) in 2003.
2) University course requirements as stated earlier. (27 Cr.Hr.)
3) Faculty of Information Technology and Computer Sciences course requirements as stated earlier. (21 Cr. Hr.):
4) Department course requirements: (86 Cr. Hr.):

First: Single Major Course Requirements (86 Cr. Hr.):

   A) Obligatory Courses (56 Cr. Hr.):

Course No.	Title	Cr. Hr.	Weekly Hours		Pre- Requisites
			Theory	Practical	
CS117	Object-Oriented Programming	3	3	0	CS101 with CS118
CS118	Object-Oriented Programming Lab.	1	0	3	with CS117
CS220	Computer Logic Design	3	0	3	Math152, Phys104, with CS225
CS225	Computer Organization Lab.	1	0	3	with CS220
CS250	Data Structures	3	0	3	CS117, with CS255
CS251	Analysis and Design of Algorithms	3	0	3	CS250, Math152,
CS255	Data structures lab	1	0	3	with CS250
CS334	Data Communications and Networks	3	0	3	CS130 with CS335
CS335	Data Communications and Networks Lab	1	0	3	with CS334
CS342A	Theory of Computation	3	0	3	Math152
CS376	Artificial Intelligence	3	0	3	CS250, Math152
CS432	Computer Architecture	3	0	3	CS220
CS434	Distributed Computing	3	0	3	CS334
CS499	Project	3	0	3	Completing 98 Cr. Hr. successfully
CIS240	Software Engineering	3	0	3	CIS104,CS117, with CIS245
CIS245	Software Engineering lab.	1	0	3	with CIS240
CIS260	Database Systems	3	0	3	CS117, CIS104
Math102	Calculus (2)	3	0	3	Math101
Math152	Discrete Mathematics	3	0	3	Math101
Math241	Linear Algebra (1)	3	0	3	Math101
Math322	Numerical Analysis	3	0	3	CS101
Phys.104	Physics for CS students	3	0	3	Math101
Total		**56**	**51**	**15**	

B) Elective Courses (30 Cr. Hr.):

1) (15 Cr. Hr.) chosen from the following (6 Cr. Hr. of them at least from CS Dept):

Course No.	Title	C. H.	Weekly Hours		Pre- Requisites
			Theory	Practical	
CS317	Advanced Programming	3	3	0	CS117
CS328	Microprocessors and Microcomputers	3	3	0	CS220
CS330	System Programming	3	3	0	CS220
CS331	Operating Systems	3	3	0	CS130
CS380	Computer Graphics	3	3	0	CS250, Math241
CS410	Programming Languages Techniques and Methodologies	3	3	0	CS317
CS431	Compiler Construction	3	3	0	CS342A
CS470	Expert Systems	3	3	0	CS376
CS480	Image Processing	3	3	0	CS376
CS492	Special Topics	3	3	0	CS376
MIS250A	Electronic Commerce	3	3	0	CIS104, MIS120
MIS421	Legal Issues in MIS	3	3	0	CIS104, MIS120
CIS281A	Multimedia Systems	3	3	0	CIS104
CIS318	Building Systems Using 4Gls	3	3	0	CIS260
CIS440	Object-Oriented Analysis and Design	3	3	0	CIS240
CIS431	Internet Services	3	3	0	CS334
CPE496*	A training Course in the IT field	3	3	0	-----

* This Courses is accredited to the student who successfully completed one of the University certified training courses.

2) (15 Cr. Hr.) chosen from the following:

A. (9 Cr. Hr.) Chosen from the following Courses of Faculty of Sciences:

Course No.	Title	C. H.	Weekly Hours		Pre- Requisites
			Theory	Practical	
MATH203	Ordinary Differential Equations (1)	3	3	0	-----
MATH281	Linear Programming and Game Theory	3	3	0	-----
PHYS202	Astronomy (1)	3	3	0	-----
STAT101	Introduction to Statistics (1)	3	3	0	-----
STAT201	Introduction to Statistics (2)	3	3	0	STAT101
STAT211	Introduction to Probability (2)	3	3	0	STAT111, Math102

B. (6 Cr. Hr.) Chosen from the following:-

Course No.	Title	C. H.	Weekly Hours		Pre- Requisites
			Theory	Practical	
BA101	Fundamentals of Management (1)	3	3	0	-----
BA498	Management Skills	3	3	0	Expected Gradate
ACC101	Accounting Principles (1)	3	3	0	-----
ECON101	Principles of Macro Economics	3	3	0	-----
BF210	Principles of Finance (1)	3	3	0	-----
FA150	Graphic Design	3	3	0	-----

Second: Major/Minor course requirements (86 Cr. Hr.):

1. Major in Computer Science (65 Cr. Hr.) as follows:

a)   *Obligatory courses (56 Cr. Hr.), same as obligatory courses for single major.*
b)   *Elective courses (9 Cr. Hr.) Chosen from following, (3 Cr. Hr. at least from Computer Science):*

Course No.	Title	C. H.	Weekly Hours		Pre- Requisites
			Theory	Practical	
CS317	Advanced Programming	3	3	0	CS117
CS328	Microprocessors and Microcomputers	3	3	0	CS220
CS330	System Programming	3	3	0	CS220
CS331	Operating Systems	3	3	0	CS130
CS380	Computer Graphics	3	3	0	CS250, Math241
CS410	Programming Languages Techniques and Methodologies	3	3	0	CS317
CS431	Compiler Construction	3	3	0	CS342A
CS470	Expert Systems	3	3	0	CS376
CS480	Image Processing	3	3	0	CS376
CS492	Special Topics	3	3	0	CS376
MIS250A	Electronic Commerce	3	3	0	CIS104, MIS120
MIS421	Legal Issues in MIS	3	3	0	CIS104, MIS120
CIS281A	Multimedia Systems	3	3	0	CIS104
CIS318	Building Systems Using 4GLs	3	3	0	CIS260
CIS440	Object-Oriented Analysis and Design	3	3	0	CIS240
CIS431	Internet Services	3	3	0	CS334
*BA498	Management Skills	3	3	0	Gradate Expected
**CPE496	A Training Course in the IT Field	3	3	0	

* In case the students take a minor in the Faculty of Economic and Administrative Sciences this course is not accredited among the 9 Cr. Hr. of this set of elective courses.

** This Courses is accredited to the student who successfully completed one of the University certified training courses.

2. Minor Specialization:

   A) The number of Cr. Hr. for the minor specialization should not be less than 21 Cr. Hr. as determined by the selected department.

   B) The minor departments: Department of Faculty of Science, Departments of Faculty of Economics and Administrative Sciences, Department of Graphic Design in the faculty of Fine Art.

Third: *Course requirements for minor in Computer Sciences (21 Cr. Hr.):*

1. Obligatory courses (15 Cr. Hr.):

Course No.	Title	C. H.	Pre- Requisites	
			Theory	Practical
CS117	Object-Oriented Programming	3	3	0
CS118	Object-Oriented Programming Lab.	1	0	3
CS250	Computer Organization Lab.	3	3	0
CS255	Data Structures Lab	1	0	3
CS251	Analysis and Design of Algorithms	3	3	0
CS334	Data Communications and Networks	3	3	0
CS335	Data Communications and Networks Lab	1	0	3

2. Elective courses (6 Cr. Hr.) Chosen from the following:

Course No.	Title	C. H.	Pre- Requisites	
			Theory	Practical
CS130	Operating Systems	3	3	0
CS317	Advanced programming	3	3	0
CS342A	Theory of computation (1)	3	3	0
CS376	Artificial intelligence	3	3	0
CS380	Computer graphics	3	3	0
CS434	Distributed computing	3	3	0

List of Courses offered by the Department of Computer Sciences:

Course No.	Title	C. H.	Weekly Hours		Pre- Requisites
			Theory	Practical	
CS100	Introduction to computers and applications	3	3	0	----
CS101A	Programming in selected language	2	2	0	with CS101B
CS101B	Programming in selected language lab	1	0	2	with CS101A
CS117	Object-oriented programming	3	3	0	CS101, with CS118
CS118	Object-oriented programming Lab.	1	0	3	with CS117
CS130	Operating Systems Fundamentals	3	3	0	CS100
CS220	Computer logic design	3	3	0	Math152, Phys104, with CS225
CS225	Computer organization Lab.	1	0	3	with CS220
CS250	Data structures	3	3	0	CS117, with CS255
CS251	Analysis and design of algorithms	3	3	0	CS250 , Math152
CS255	Data structures lab	1	0	3	with CS250
CS317	Advanced programming	3	3	0	CS117
CS328	Microprocessors and microcomputers	3	3	0	CS220
CS330	System programming	3	3	0	CS220
CS331	Operating Systems	3	3	0	CS130
CS334	Data Communications and networks	3	3	0	CS130, with CS335
CS335	Data Communications and networks Lab	1	0	3	with CS334
CS342A	Theory of computation	3	3	0	Math152
CS376	Artificial intelligence	3	3	0	CS250, Math152
CS380	Computer graphics	3	3	0	CS250, Math241
CS410	Programming languages techniques and methodologies	3	3	0	CS317
CS431	Compiler construction	3	3	0	CS342A
CS432	Computer architecture	3	3	0	CS220
CS434	Distributed computing	3	3	0	CS334
CS470	Expert systems	3	3	0	CS376
CS480	Image processing	3	3	0	CS376
CS492	Special topics	3	3	0	CS376
CS499	Project	3	3	0	Completing 98 credits successfully

Description of Courses

Offered by the

Department of Computer Sciences (CS)

CS 100: INTRODUCTION TO COMPUTERS AND APPLICATIONS   3 Hrs.   (Prereq.:--)

The main objective of this course is to provide students with the ability to utilize commonly used computer applications in their daily life and work. It covers a range of topics and applications including: general overview of computer hardware technology computer software systems, MS Windows, word processing, spreadsheets, Power Point presentations, Web browsing …etc.

CS 101A: PROGRAMMING IN A SELECTED LANGUAG   2 Hrs.   (Co-req.: CS101B)

The main objective of this course is to introduce students to the basic concepts of a selected programming language (such as C++) and the ability to write simple correct programs. Topics to be covered include: I/O, data types, function definition, visibility and storage classes, parameter passing, loops, arrays, pointers, strings, files, introducing classes and objects, constructors and destructors, function prototypes, private and public access, and class implementation. The practical part of this course is covered in the lab through exercises, practical assignments, and tutorials.

CS 101B: PROGRAMMING IN A SELECTED LANGUAG LAB   1 hr. (Co-req.: CS101A)

The objective of this course is to provide students with the opportunity to implement the programming concepts and techniques taught in CS101A. Exercises and case studies will be prepared in conjunction with the material covered in CS101A.

**CS 117: OBJECT-ORIENTED PROGRAMMING   3 Hrs.   (Prereq.: CS101A, CS101B,
                                                                    Co-req.: CS118)**

The objective of this course is to provide students with knowledge and needed skills in order to design and develop object-oriented programs. Topics to be covered include: the object-oriented approach, classes, method, object inheritance, replacement and refinement, static and dynamic binding, polymorphism, visibility and dependency, files and storage issues. The course is supplemented by a lab component covered in CS118 concurrently.

CS 118: OBJECT-ORIENTED PROGRAMMING LAB   1 hr.   (Co-req.: CS117)

The objective of this course is to provide students with the opportunity to implement the programming concepts and techniques taught in CS117. Exercises and case studies will be prepared in conjunction with the material covered in CS117.

CS 130: FUNDAMENTALS OF OPERATING SYSTEMS   3 Hrs.   (Prereq.: CS100)

The objective of this course is to provide students with the basic knowledge and skills of operating, managing, and maintaining microcomputer systems. Hands-on experience with windows environment is a major concern in this course. It covers a range of topics including: operating system concepts, functions, and components, a general overview of OS services, process management, CPU scheduling, memory management, virtual memory and file system, installing, partitioning, configuring and upgrading Windows, common errors and problems and how to solve them, networking capabilities of Windows. Windows commands, system programs, and Windows facilities are covered in the practical component.

CS 220: COMPUTER LOGIC DESIGN   3 Hrs.   (Prereq.: Math 152, Phys104, CIS103, Co-req.: CS225)

The objective of this course is to introduce students to the basic concepts in digital logic and how the electronic circuits work inside the computer. Topics to be covered include: Binary Systems, Conversion, Boolean expression and its simplification methods, Combinational logic circuits, MSI and LSI, flip-flops and sequential logic circuits, registers, counters, memory units. The course has a lab CS225 taken concurrently with it.

CS 225: COMPUTER ORGANIZATION LAB   1 Hr.   (Co-req.: CS220)

This course is intended to cover the practical aspects related to computer organization, architecture, and logic. Students are trained to write simple assembly programs to explore and analyze microcomputer organization and architecture.

CS 250: DATA STRUCTURES   3 Hrs.   (Prereq.: CS117, Co-req.: CS255)

The objective of this course is to introduce students to various types of data structures, their logical and physical representations, and their related operations. Topics to be covered include: data structure operations, dense lists and matrix representations, linked lists and their different variations, string storage representation and manipulation, queues and stacks and their applications, tree structures and their different variations, graphs and networks. The course is supplemented by a lab component covered in CS255 concurrently.

CS 251: ANALYSIS AND DESIGN OF ALGORITHMS   3 Hrs.   (Prereq.: CS250, Math 152)

The objective of this course is to provide students with the knowledge and skills in complexity analysis and design of computer algorithms. Topics to be covered include: sorting algorithms, search algorithms, divide and conquer, greedy method, trees, graphs, dynamic programming, backtracking, branch and bound, Lower bound theory, NP-complete problems. The practical part of the course will include writing programs for solving problems using techniques taught in this course.

CS 255: DATA STRUCTURES LAB   **1 Hr.**   **(Co-req.: CS250)**

The objective of this lab is to teach students to program what they learned in CS250 using a high-level programming language in order to enhance their understanding of the main data structures concepts including stacks, queues, linked list, trees, graphs, … etc.

CS 317: ADVANCED PROGRAMMING   **3 Hrs.**   **(Prereq.: CS117)**

This course is intended to teach students a popular high level programming language based on the demands of the job market. Topics to be covered include: syntax rules and structures, special programming features of the language in comparison with other languages, how data is processed using this language, compilation and implementation issues, files and storage mechanisms, other facilities provided by the language. The practical part of the course will include case studies, exercises and a project.

CS 328: MICROPROCESSORS AND MICROCOMPUTERS   **3 Hrs.**   **(Prereq.: CS220)**

The objective of this course is to introduce students to the evolution of microprocessor systems, their characteristics and applications. Topics to be covered include: machine instructions and addressing modes, microprogramming and assembly languages, pins functions, asynchronous data transfer, decoding, programming in direct memory access controller (DMA) and programmable interface controller (PIC), 16-bit and 32-bit families. The practical part of the course students will be asked to write simple programs using the assembly language for a well known microprocessor.

CS 330: SYSTEM PROGRAMMING   **3 Hrs.**   **(Prereq.: CS220)**

The objective of this course is to provide students with the knowledge and skills related to the design and implementation of various systems programs. Topics to be covered include: text editors, file utilities, monitors, assemblers, relocating linking loaders, I/O handlers, schedulers, programming language definitions, design of interpreter and compiler programs. The practical part of the course will include writing simple programs in the system programs covered in the course.

CS 331: OPERATING SYSTEMS   **3 Hrs.**   **(Prereq.: CS130)**

This course builds on the knowledge and skills gained from the course CS130. Its objective is to provide students with more advanced concepts, techniques, and in-depth knowledge in issues that have not been covered in the introductory course. Topics to be covered include: operating system types, operating system structures, systems calls, inter-process communication, communication in client/server systems, multithreading, process synchronization, deadlocks, advanced topics in storage management and virtual memory, file system structure and implementation, mass storage structure management, RAID technology. The practical part of the course involves case studies and a practical component in some operating systems not covered in CS130 such as Linux or UNIX.

CS 334: DATA COMUNICATIONS AND NETWORKS   **3 Hrs.**   **(Prereq.: CS130,**
                                                           Co-req.: CS335)

The objective of this course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN and Wireless networks) and their protocols. The course is supplemented by a practical component covered in CS335 concurrently.

CS 335: DATA COMMUNICATIONS AND NETWORKS LAB: **1 Hr.**   **(Co-req.: CS334)**

The objective of this lab is to introduce students to the design issues that arise in building and using networks and to give students hands on experience with building and using network services. The practical issues to be stressed include design and installation of LAN, network operating system, setting up a network system such as users and their permissions and rights, groups and domains, adding workstations and sharing of resources across the network

CS 342A: THEORY OF COMPUTATION   **3 Hrs.**   **(Prereq.: Math.152)**

The objective of this course is to introduce students to formal languages and their representation, automata, and theory of computation. Topics to be covered include: formal languages and their representation, different grammars, finite automata: deterministic and non-deterministic, regular languages, regular expressions, context-free languages, push-down automata, Turing machines and computability, universal Turing machine, computability and complexity.

CS 376: ARTIFICIAL INTELLIGENCE   **3 Hrs.**   **(Prereq.: CS250, Math. 152)**

The objective of this course is to provide students with the basic concepts, knowledge and skills required in utilizing Artificial Intelligence techniques in solving practical problems. Topics to be covered include: knowledge representation methods like propositional logic and predicate calculus, blind search strategies (breadth-first and depth-first), heuristic search strategies (hill-climbing, best-first and A*), backward and forward reasoning, applications: expert systems, natural language processing, pattern recognition, image processing, and planning. The practical part of the course involves programming exercises and case studies related to the topics covered.

CS 380: COMPUTER GRAPHICS   **3 Hrs.**   **(Prereq.: CS250, Math 241)**

The objective of this course is to provide students with the basic concepts, technical and mathematical knowledge and skills required to design and implement computer graphics. Topics to be covered include: graphics hardware, software utilities, two and three dimensional transmutation and viewing, graphics arts and animations. Students are expected to be design programs using programming graphics tools and libraries such as Open GL to perform practical assignments.

CS 410: PROGRAMMING LANGUAGE TECHNIQUE AND METHODOLGIES   3 Hrs.
(Prereq.: CS317)

The objective of this course is to introduce students to the main concepts, principles, techniques and paradigms of designing and implementing programming languages. Topics to be covered include: language components, evolution of major imperative programming languages, language taxonomy, data types and objects, expressions and statements, subprograms, modules and packages, scope rules and visibility, passing parameters, activation records and call management, concurrent programming, exception handling, functional programming languages, logic programming, object-oriented programming, examples and comparative case studies.

CS 431: COMPILER CONSTRUCTION   3 Hrs.   (Prereq.: CS342A)

The objective of this course is to provide students with the skills and basic knowledge of the concepts, techniques, and approaches used for designing and implementing compilers. Topics to be covered include: compiler components, lexical analysis, symbol tables handling, parsing techniques, error handling and recovery, syntax-directed translation, type checking, intermediate code generation, code generation, code optimization. Students are expected to design and implement a compiler or an interpreter for a simple programming language.

CS 432: COMPUTER ARCHITECTURE   3 Hrs.   (Prereq.: CS220)

The objective of this course is to introduce students to the basic concepts and various techniques of computer architecture. Topics to be covered include: ALU design, IEEE 754 format for floating-point numbers, coprocessors, design of hardwired CU and micro-programmed CU, the characteristics of instruction sets, pipelines techniques, the architecture of RISC and CISC machine, (cache) high speed memories, I/O channels and I/O processors, parallel processing.

CS 434: DISTRBUTED COMPUTING   3 Hrs.   (Prereq.: CS 334)

The objective of this course is to introduce students to the fundamentals and techniques of distributed computing and provide them with the basic skills of how to write distributed programs. Topics to be covered include: distributed computing, distributed programming, distributed systems, concurrency, distributed computing paradigms, inter-process communications, group communications, operating system support, distributed objects, application programming interfaces (RMI, RPC), client server model, the socket API, security issues and Internet applications. Students are expected to develop distributed applications using latest technologies.

CS 470: EXPERT SYSTEMS   3 Hrs.   (Prereq.: CS376)

The objective of this course is to provide students with the knowledge and skills required for developing expert systems and applying them in real-life application problems. Topics to be covered include: knowledge acquisition, knowledge representation techniques, inference methods, reasoning under uncertainty, design of expert systems, and introduction to an expert system programming tool, expert systems case studies. In the practical part of the course students are expected to design a small expert system using an expert system programming tool.

CS 480: IMAGE PROCESSING   **3 Hrs.**   **(Prereq.: CS376)**

This course is intended to provide students with an introduction to the basic concepts techniques, and technologies of digital image processing. Topics to be covered include: image and video representation technologies, image enhancement and filtering techniques, mathematical morphology, noise removal techniques, image compression techniques, edge detection and segmentation techniques.

CS 492: SPECIAL TOPICS   **3 Hrs.**   **(Prereq.: CS376)**

In this course a topic in computer science is selected not covered in the list of courses described above to be taught to students, with the approval of the department board.

CS 499: Graduation Project   **3 Hrs.**   **(Prereq.: Passing 98 hours)**

The objective of this course is to gives students an opportunity to utilize the knowledge and skills gained in other courses in a real-life application problem. The student is supposed to analyze the problem, design a software solution to it, coding the solution in a programming language, and writing the documentation in the form of a project report using a standard w

Description of Courses

Offered by the

Department of Computer Sciences (CS)

CS 100: INTRODUCTION TO COMPUTERS AND APPLICATIONS   3 Hrs.   (Prereq.:--)

The main objective of this course is to provide students with the ability to utilize commonly used computer applications in their daily life and work. It covers a range of topics and applications including: general overview of computer hardware technology computer software systems, MS Windows, word processing, spreadsheets, Power Point presentations, Web browsing …etc.

CS 101A: PROGRAMMING IN A SELECTED LANGUAG   2 Hrs.   (Co-req.: CS101B)

The main objective of this course is to introduce students to the basic concepts of a selected programming language (such as C++) and the ability to write simple correct programs. Topics to be covered include: I/O, data types, function definition, visibility and storage classes, parameter passing, loops, arrays, pointers, strings, files, introducing classes and objects, constructors and destructors, function prototypes, private and public access, and class implementation. The practical part of this course is covered in the lab through exercises, practical assignments, and tutorials.

CS 101B: PROGRAMMING IN A SELECTED LANGUAG LAB   1 hr. (Co-req.: CS101A)

The objective of this course is to provide students with the opportunity to implement the programming concepts and techniques taught in CS101A. Exercises and case studies will be prepared in conjunction with the material covered in CS101A.

CS 117: OBJECT-ORIENTED PROGRAMMING   3 Hrs.   (Prereq.: CS101A, CS101B, Co-req.: CS118)

The objective of this course is to provide students with knowledge and needed skills in order to design and develop object-oriented programs. Topics to be covered include: the object-oriented approach, classes, method, object inheritance, replacement and refinement, static and dynamic binding, polymorphism, visibility and dependency, files and storage issues. The course is supplemented by a lab component covered in CS118 concurrently.

CS 118: OBJECT-ORIENTED PROGRAMMING LAB   1 hr.   (Co-req.: CS117)

The objective of this course is to provide students with the opportunity to implement the programming concepts and techniques taught in CS117. Exercises and case studies will be prepared in conjunction with the material covered in CS117.

CS 130: FUNDAMENTALS OF OPERATING SYSTEMS   3 Hrs.   (Prereq.: CS100)

The objective of this course is to provide students with the basic knowledge and skills of operating, managing, and maintaining microcomputer systems. Hands-on experience with windows environment is a major concern in this course. It covers a range of topics including: operating system concepts, functions, and components, a general overview of OS services, process management, CPU scheduling, memory management, virtual memory and file system, installing, partitioning, configuring and upgrading Windows, common errors and problems and how to solve them, networking capabilities of Windows. Windows commands, system programs, and Windows facilities are covered in the practical component.

CS 220: COMPUTER LOGIC DESIGN   3 Hrs.   (Prereq.: MATH 152, CIS103, Co-req.: CS225)

The objective of this course is to introduce students to the basic concepts in digital logic and how the electronic circuits work inside the computer. Topics to be covered include: Binary Systems, Conversion, Boolean expression and its simplification methods, Combinational logic circuits, MSI and LSI, flip-flops and sequential logic circuits, registers, counters, memory units. The course has a lab CS225 taken concurrently with it.

CS 225: COMPUTER ORGANIZATION LAB   1 Hr.   (Co-req.: CS220)

This course is intended to cover the practical aspects related to computer organization, architecture, and logic. Students are trained to write simple assembly programs to explore and analyze microcomputer organization and architecture.

CS 250: DATA STRUCTURES   3 Hrs.   (Prereq.: CS117, Co-req.: CS255)

The objective of this course is to introduce students to various types of data structures, their logical and physical representations, and their related operations. Topics to be covered include: data structure operations, dense lists and matrix representations, linked lists and their different variations, string storage representation and manipulation, queues and stacks and their applications, tree structures and their different variations, graphs and networks. The course is supplemented by a lab component covered in CS255 concurrently.

CS 251: ANALYSIS AND DESIGN OF ALGORITHMS   3 Hrs. (Prereq.: CS250, Math 152)

The objective of this course is to provide students with the knowledge and skills in complexity analysis and design of computer algorithms. Topics to be covered include: sorting algorithms, search algorithms, divide and conquer, greedy method, trees, graphs, dynamic programming,

backtracking, branch and bound, Lower bound theory, NP-complete problems. The practical part of the course will include writing programs for solving problems using techniques taught in this course.

CS 255: DATA STRUCTURES LAB   **1 Hr.**   **(Co-req.: CS250)**

The objective of this lab is to teach students to program what they learned in CS250 using a high-level programming language in order to enhance their understanding of the main data structures concepts including stacks, queues, linked list, trees, graphs, … etc.

CS 317: ADVANCED PROGRAMMING   **3 Hrs.**   **(Prereq.: CS117)**

This course is intended to teach students a popular high level programming language based on the demands of the job market. Topics to be covered include: syntax rules and structures, special programming features of the language in comparison with other languages, how data is processed using this language, compilation and implementation issues, files and storage mechanisms, other facilities provided by the language. The practical part of the course will include case studies, exercises and a project.

CS 328: MICROPROCESSORS AND MICROCOMPUTERS   **3 Hrs.**   **(Prereq.: CS220)**

The objective of this course is to introduce students to the evolution of microprocessor systems, their characteristics and applications. Topics to be covered include: machine instructions and addressing modes, microprogramming and assembly languages, pins functions, asynchronous data transfer, decoding, programming in direct memory access controller (DMA) and programmable interface controller (PIC), 16-bit and 32-bit families. The practical part of the course students will be asked to write simple programs using the assembly language for a well known microprocessor.

CS 330: SYSTEM PROGRAMMING   **3 Hrs.**   **(Prereq.: CS220)**

The objective of this course is to provide students with the knowledge and skills related to the design and implementation of various systems programs. Topics to be covered include: text editors, file utilities, monitors, assemblers, relocating linking loaders, I/O handlers, schedulers, programming language definitions, design of interpreter and compiler programs. The practical part of the course will include writing simple programs in the system programs covered in the course.

CS 331: OPERATING SYSTEMS   **3 Hrs.**   **(Prereq.: CS130)**

This course builds on the knowledge and skills gained from the course CS130. Its objective is to provide students with more advanced concepts, techniques, and in-depth knowledge in issues that have not been covered in the introductory course. Topics to be covered include: operating system types, operating system structures, systems calls, inter-process communication, communication in client/server systems, multithreading, process synchronization, deadlocks, advanced topics in storage management and virtual memory, file system structure and implementation, mass storage structure management, RAID technology. The practical part of

the course involves case studies and a practical component in some operating systems not covered in CS130 such as Linux or UNIX.

CS 334: DATA COMUNICATIONS AND NETWORKS   3 Hrs.   (Prereq.: CS130, Co-req.: CS335)

The objective of this course is to provide students with an overview of the concepts and fundamentals of data communication and computer networks. Topics to be covered include: data communication concepts and techniques in a layered network architecture, communications switching and routing, types of communication, network congestion, network topologies, network configuration and management, network model components, layered network models (OSI reference model, TCP/IP networking architecture) and their protocols, various types of networks (LAN, MAN, WAN and Wireless networks) and their protocols. The course is supplemented by a practical component covered in CS335 concurrently.

CS 335: DATA COMMUNICATIONS AND NETWORKS LAB: 1 Hr.   (Co-req.: CS334)

The objective of this lab is to introduce students to the design issues that arise in building and using networks and to give students hands on experience with building and using network services. The practical issues to be stressed include design and installation of LAN, network operating system, setting up a network system such as users and their permissions and rights, groups and domains, adding workstations and sharing of resources across the network

CS 342: THEORY OF COMPUTATION   3 Hrs.   (Prereq.: CS220)

The objective of this course is to introduce students to formal languages and their representation, automata, and theory of computation. Topics to be covered include: formal languages and their representation, different grammars, finite automata: deterministic and non-deterministic, regular languages, regular expressions, context-free languages, push-down automata, Turing machines and computability, universal Turing machine, computability and complexity.

CS 376: ARTIFICIAL INTELLIGENCE   3 Hrs.   (Prereq.: CS250, MATH 152)

The objective of this course is to provide students with the basic concepts, knowledge and skills required in utilizing Artificial Intelligence techniques in solving practical problems. Topics to be covered include: knowledge representation methods like propositional logic and predicate calculus, blind search strategies (breadth-first and depth-first), heuristic search strategies (hill-climbing, best-first and A*), backward and forward reasoning, applications: expert systems, natural language processing, pattern recognition, image processing, and planning. The practical part of the course involves programming exercises and case studies related to the topics covered.

CS 380: COMPUTER GRAPHICS   3 Hrs.   (Prereq.: CS250, Math 241)

The objective of this course is to provide students with the basic concepts, technical and mathematical knowledge and skills required to design and implement computer graphics. Topics to be covered include: graphics hardware, software utilities, two and three dimensional

transmutation and viewing, graphics arts and animations. Students are expected to be design programs using programming graphics tools and libraries such as Open GL to perform practical assignments.

CS 410: PROGRAMMING LANGUAGE TECHNIQUE AND METHODOLGIES   3 Hrs.
(Prereq.: CS317)

The objective of this course is to introduce students to the main concepts, principles, techniques and paradigms of designing and implementing programming languages. Topics to be covered include: language components, evolution of major imperative programming languages, language taxonomy, data types and objects, expressions and statements, subprograms, modules and packages, scope rules and visibility, passing parameters, activation records and call management, concurrent programming, exception handling, functional programming languages, logic programming, object-oriented programming, examples and comparative case studies.

CS 431: COMPILER CONSTRUCTION   3 Hrs.   (Prereq.: CS342)

The objective of this course is to provide students with the skills and basic knowledge of the concepts, techniques, and approaches used for designing and implementing compilers. Topics to be covered include: compiler components, lexical analysis, symbol tables handling, parsing techniques, error handling and recovery, syntax-directed translation, type checking, intermediate code generation, code generation, code optimization. Students are expected to design and implement a compiler or an interpreter for a simple programming language.

CS 432: COMPUTER ARCHITECTURE   3 Hrs.   (Prereq.: CS220)

The objective of this course is to introduce students to the basic concepts and various techniques of computer architecture. Topics to be covered include: ALU design, IEEE 754 format for floating-point numbers, coprocessors, design of hardwired CU and micro-programmed CU, the characteristics of instruction sets, pipelines techniques, the architecture of RISC and CISC machine, (cache) high speed memories, I/O channels and I/O processors, parallel processing.

CS 434: DISTRBUTED COMPUTING   3 Hrs.   (Prereq.: CS 334)

The objective of this course is to introduce students to the fundamentals and techniques of distributed computing and provide them with the basic skills of how to write distributed programs. Topics to be covered include: distributed computing, distributed programming, distributed systems, concurrency, distributed computing paradigms, inter-process communications, group communications, operating system support, distributed objects, application programming interfaces (RMI, RPC), client server model, the socket API, security issues and Internet applications. Students are expected to develop distributed applications using latest technologies.

CS 470: EXPERT SYSTEMS   3 Hrs.   (Prereq.: CS376)

The objective of this course is to provide students with the knowledge and skills required for developing expert systems and applying them in real-life application problems. Topics to be covered include: knowledge acquisition, knowledge representation techniques, inference methods, reasoning under uncertainty, design of expert systems, and introduction to an expert system programming tool, expert systems case studies. In the practical part of the course students are expected to design a small expert system using an expert system programming tool.

CS 480: IMAGE PROCESSING   **3 Hrs.**   **(Prereq.: CS376)**

This course is intended to provide students with an introduction to the basic concepts techniques, and technologies of digital image processing. Topics to be covered include: image and video representation technologies, image enhancement and filtering techniques, mathematical morphology, noise removal techniques, image compression techniques, edge detection and segmentation techniques.

CS 492: SPECIAL TOPICS   **3 Hrs.**   **(Prereq.: CS376)**

In this course a topic in computer science is selected not covered in the list of courses described above to be taught to students, with the approval of the department board.

CS 499: Graduation Project   **3 Hrs.**   **(Prereq.: Passing 98 hours)**

The objective of this course is to gives students an opportunity to utilize the knowledge and skills gained in other courses in a real-life application problem. The student is supposed to analyze the problem, design a software solution to it, coding the solution in a programming language, and writing the documentation in the form of a project report using a standard way.