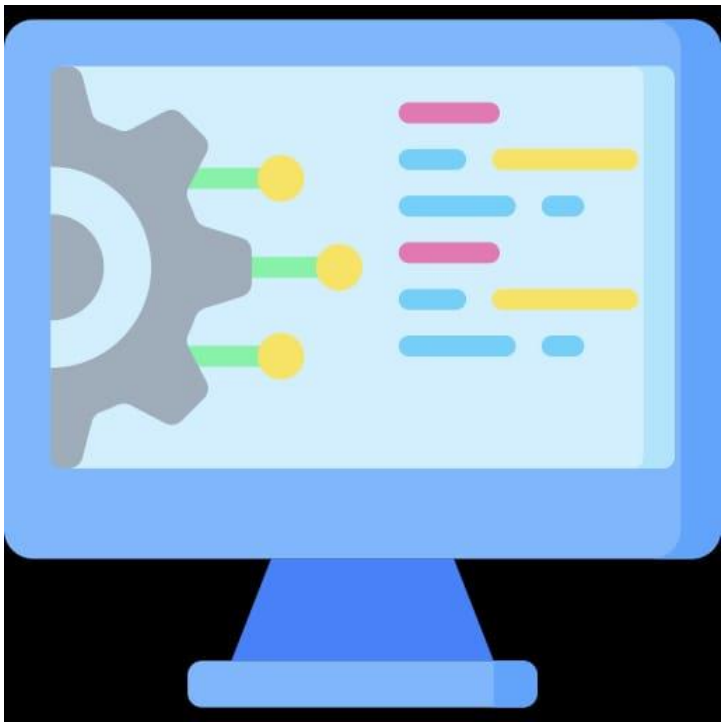
Computer Systems Program

FACULTY OF COMPUTER & INFORMATION SCIENCES
(AIN SHAMS UNIVERSITY)



(2024 – 2025)

Table of Contents

WELCOME AND INTRODUCTION

INTRODUCTION / WELCOME FROM PROGRAM MANAGEMENT

The Faculty of Computer and Information Sciences (FCIS) is located on Ain Shams University's main campus. When FCIS was founded in 1995, three programs were initially available. The first graduating class was in 2000. Currently, the Faculty of Computer and Information Sciences (FCIS) offers ten programs. In 2019, the National Accreditation and Quality Assurance Authority of Education (NAQAAE) accredited nine of them. FCIS recently maintained its position as a top-tier educational institution by obtaining the government's Excellence award for the years 2022 and 2023. Furthermore, the Faculty of Computer and Information Sciences has numerous agreements for educational and research cooperation on a national and international level, such as the Memorandum of between Information Engineering and Computer Science of the University of Trento, Italy, and Vidzems University Applied Sciences - Erasmus + Mobility. FCIS offers a number of consulting divisions that help many partners and stakeholders with computer and information science objectives, such as automating ASU through university payroll systems and UMS (University Management System). The FCIS has active agreements for collaboration with various entities and stakeholders in the field of computer systems, such as Dell Corporation, Huawei Corporation, and ITI (information technology institute), to train students.

The faculty maintains close relationships with industrial and international partners to assure leadership and provide our students with the best opportunities for advancement.

This handbook is intended for all students taking the “Bachelor of Computer and Information Sciences" with a computer systems major. You will find it a useful information guide at the start and during your study in the program. We are confident that you will enjoy studying with our computer systems program.

Sincerely,

Prof. Dr. Nagwa Badr
(Dean of Faculty of Computer and Information Sciences - Ain Shams University)

Prof. Dr. Eman Shabaan
(Head of Computer Systems Department, Faculty of Computer & Information Sciences - Ain Shams University)

INTRODUCTION TO THE PROGRAM

This program aims to study the processes that interact with data and that can be represented in the form of programs. Where the student studies the use of algorithms to process and store information, design software systems and computing systems themselves study the use of

computer graphics in various applications, studies different programming languages, different means of interaction between humans and computers, expert systems, natural language processing, distinguishing sounds, distinguishing and analyzing images and different patterns.

PROGRAM DURATION AND MODES OF STUDY

Students can join the computer systems program once they have completed the 69 credit hours to become a level 3 student. The computer systems program has no tracks or concentrations. This program's official degree title is "Bachelor of Computer and Information Sciences" with a Computer Systems major.

PROGRAM MISSION

The Computer Systems program at Faculty of Computer and Information Sciences, Ain Shams University is dedicated to fostering exceptional abilities in computer systems aiming to play a significant role in the advancement of society and the job market. It offers a comprehensive learning atmosphere that cultivates both theoretical and practical skills, encourages innovation, scientific inquiry, and community involvement.

PROGRAM GOALS

1. Apply knowledge of computing and numerical techniques appropriate to the computer systems discipline.
2. Explore programming languages and paradigms, design and analysis of algorithms, data structures, and databases.
3. Understand the principles and applications of computer systems areas including computer design and architecture, data communication, hardware interfacing, embedded systems, and other related areas.
4. Solve computer systems problems, and design integrated computer systems.
5. Qualify students for competent, responsible, and rewarding careers in the computer systems profession.
6. Introduce research concepts in computer systems field that leads to master’s degrees.

GRADUATE ATTRIBUTES

The Computer Systems program is designed to provide the student with the foundations of discipline as well as the opportunity for specialization. After successfully completing the computer systems program, the graduate should be able to:

1. Demonstrate the ability to apply knowledge of hardware system design, computing and mathematics.
2. Design and conduct experiments, analyze, and interpret data and embedded systems.
3. Design a system, component, process, or software package to meet desired needs within problem constraints.

4. Work effectively in multi-disciplinary teams to design and implement software systems.
5. Identify, formulate, solve computer systems problems, and evaluate solutions.
6. Communicate effectively in both written and oral form.
7. Use the techniques, skills, and modern engineering tools necessary for modern computer systems practice.
8. Understand the fundamentals of computer programming, networking, computer organization, computer architecture, artificial intelligence, graphics, networking, computer interfacing, databases, embedded applications and computer and network security and operating systems.
9. Understand different aspects of digital signal processing.

CURRICULUM STRUCTURE & CONTENT

- Program duration: 140 hours.

- Program structure
  - Compulsory 119 credit hours (115 CH courses + 4 CH training)
  - Program Levels: 4 levels.
  - Level1: 33 credit hours (29 required, 4 selected)
  - Level2: 34 credit hours (32 required, 2 selected)
  - Level3: 33 credit hours (required)
  - Level 4: 36 credit hours (21 required, 15 selected)

The following table summarizes the program structure.

	Subject Area	Number of Credit Hours	Number of Courses	Percentage of Credit Hours	Tolerance % in NARS
A	University Requirements (Humanities, ethical and Social Sciences)	12	6	8.6%	8-10%
B	Mathematics and Basic Sciences	25	8	18%	16-18%
C	Faculty Requirements (Basic Computing Sciences)	45	15	32.1%	26-28%

D G	Program Requirements (specialization) + Optional (Institution character-identifying subjects)	48	16	34.2%	28-30% + 16-4%
E	Training	4	-	2.8%	3-5%
F	Projects	6	-	4.3%	3-5%
	Total	140	45	100%	

PROGRAM CONTENTS

Level 1: 1st Semester

Code No.	**Course Title**	**Credit Hours**	**No. of hours/week**		
			Lect.	**Tut.**	**Lab.**
CIS160	Introduction to Computer Sciences	3	2	-	2
BSC121	Physics I	3	2	1	1
BSC122	Calculus I	3	2	2	-
HUM110	English Language I	2	2	-	-
BSC123	Probability & Statistical	3	2	2	-
STU130	Selected Uni. Topic (1)	2	2	-	-
STU140	Selected Uni. Topic (2)	2	2	-	-
	Total Hours	**18**			

Level 1: 2nd Semester

Code No.	Course Title	Credit Hours	No. of hours/week			Co-requisites
			Lect.	Tut.	Lab.	
CIS150	Structured Programming	3	2	-	2	CIS160. Introduction to Computer Sciences
CIS124	Electronics	4	2	2	2	BSC121. Physics I
BSC125	Calculus II	3	2	2	-	BSC122. Calculus I
STU150	Selected Uni. Topic (3)	2	2	-	-	-
BSC126	Physics II	3	2	1	1	BSC121. Physics I
HUM119	Human Rights &Combating Corruption	2	2	-	-	
	Total Hours	**17**				

Level 2: 3rd Semester

Code No.	Course Title	Credit Hours	No. of hours/week			Co-requisites
			Lect.	Tut.	Lab.	
HUM113	Report Writing	2	2	-	-	-
CIS250	Object Oriented Programming	3	2	-	2	CIS150. Structured Programming
BSC221	Discrete Mathematics	3	2	2	-	-
CIS260	Logic Design	3	2	-	2	BSC121. Physics I
CIS280	Database Management Systems	3	2	2	-	CIS150. Structured Programming
CIS240	Statistical Analysis	3	2	2	-	BSC123. Probability & Statistics
	Total Hours	**17**				

Level 2: 4th Semester

Code No.	Course Title	Credit Hours	No. of hours/week			Co-requisites
			Lect.	Tut.	Lab.	
CIS220	Computer Organization & Architecture	3	2	-	2	CIS260. Logic Design
CIS270	Data Structure	3	2	-	2	CIS250. Structured Programming
BSC225	Linear Algebra	3	2	2	-	-
CIS230	Operations Research	3	2	2	-	-
CIS243	Artificial Intelligence	3	2	-	2	CIS 150. Structured Programming
	Total Hours	**15**				

Level 3: 5th Semester

Code No.	Course Title	Credit Hours	No. of hours/week			Co-requisites
			Lect.	Tut.	Lab.	
CIS353	Operating Systems	3	2	-	2	CIS220. Computer Organization & Architecture
CIS365	Computer Networks	3	2	-	2	CIS160. Introduction to Computer Sciences
CIS290	System Analysis & Design	3	2	2	-	CIS280. Database Management Systems
SCO321	Digital Signal Processing	3	2	-	2	BSC125. Calculus II
CSY340	Microprocessors & Interfacing	3	2	-	2	CIS220. Computer Organization & Architecture
	Total Hours	**15**				

Level 3: 6th Semester

Code No.	Course Title	Credit Hours	No. of hours/week			Co-requisites
			Lect.	Tut.	Lab.	
CIS380	Software Engineering	3	2	-	2	CIS 150. Structured Programming
CIS340	Analysis & Design of Algorithms	3	2	-	2	CIS 150. Structured Programming
CSY350	Embedded System	3	2	-	2	CSY340. Microprocessors & Interfacing
CSY320	Data Communication	3	2	-	2	BSC125. Calculus II
CSY330	High Performance Computing	3	2	-	2	CIS353. Operating Systems
CSY410	Computer and Network Security	3	2	-	2	-
	Total Hours	**18**				

Level 4: 7th Semester

Code No.	Course Title	Credit Hours	No. of hours/week			Co-requisites
			Lect.	Tut.	Lab.	
CSY420	Real-time Systems	3	2	-	2	CSY350. Embedded System
INF421	Mobile Computing	3	2	2	-	CIS150. Structured Programming, CIS365. Computer networks
INF421	Parallel and Distributed Architectures	3	2	-	2	CSY330. High Performance Computing
SCO421	Computer Vision	3	2	-	2	CIS243. Artificial Intelligence
STY310	Selected Topic (1)	3	2	-	2	-
STY320	Selected Topic (2)	3	2	-	2	-
PRO400	Project	3	-	1	5	-
	Total Hours	**18**				

Level 4: 8th Semester

Code No.	Course Title	Credit Hours	No. of hours/week			Co-requisites
			Lect.	Tut.	Lab.	
INF412	Cloud Computing	3	2	-	2	CIS365. Computer networks
STY330	Selected Topic (3)	3	2	-	2	-
STY340	Selected Topic (4)	3	2	-	2	-
STY350	Selected Topic (5)	3	2	-	2	-
PRO400	Project	3	-	1	5	-
	Total Hours	**18**				

KEY STAFF, CONTACT DETAILS AND STAFF ROLES

The Key Staff and Contact Details are correct at point of publication. You will be notified of any changes.

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PROGRAM OPERATION AND STUDENT REGISTRATION

Regulations for progression and program completion

Students are directed at the end of their second year to choose one of four programs, one of which is Computer Systems. Students are admitted into the program based on the number of students the program will accept that year and their cumulative GPA.

Rules for progression are the same overall years of the program. These rules are:

- Student must complete 140 credit hours, with average GPA not less than 2:00 and pass all PASS/Fail Courses.
- Student attendance should be at least 75% from lecture, tutorial and lab hours of each course, other wise student is considered failed and forbidden to attend the final written exam of the course.
- Student must attend at least two summer training courses to graduate during his academic years, each summer training is at least 3 weeks inside the faculty, or outside.
- Level 4 students must propose, present, and implement a graduation, and must successfully pass at least 94 credit hours to register in graduation project and each group of students can choose their graduation project under their academic supervisor supervision.

Assessment Methods (Evaluation Techniques):

Final Exam

Midterm

Quiz

Year Work

Practical

Evaluation of Program Intended Learning Outcomes

Evaluator	Tool	Sample
1- Senior students	Evaluation sheets	Suitable number
2- Alumni	Evaluation sheets and Interviews	Suitable number
3- Stakeholders (Employers)	Evaluation sheets and Interviews	2
4- External Evaluator (s) (External Examiner (s))	Evaluation Report	1 or 2
5- Other	---	

GRADING STANDARDS

The letter grades of A+, A, A-, B+, B, B-, C+, C, C-, D, D- indicate passing grades; a grade of F, however, is not allowed to progress to the next level course. Table 1-2 illustrates the grading system.

Table 1. The grading system

Grade	GPA	Percentage
A+	4.0	97% and up
A	4.0	93% to 97%
A-	3.7	89% to 93%
B+	3.3	84% to 89%
B	3.0	80% to 84%
B-	2.7	76% to 80%
C+	2.3	73% to 76%
C	2.0	70% to 73%
C-	1.7	67% to 70%
D+	1.3	64% to 67%
D	1.0	60% to 64%
F	0	Less than 60%

THE HIERARCHY OF THE PROGRAM AND MANAGEMENT

Prof. Eman Shaaban is a professor of Computer Systems. The program Chair is directly responsible for monitoring the Computer Systems program and supervising department members and teaching assistants. Figure 1 shows the faculty's organizational structure hierarchy. All program faculty members meet to discuss any program-related concerns.

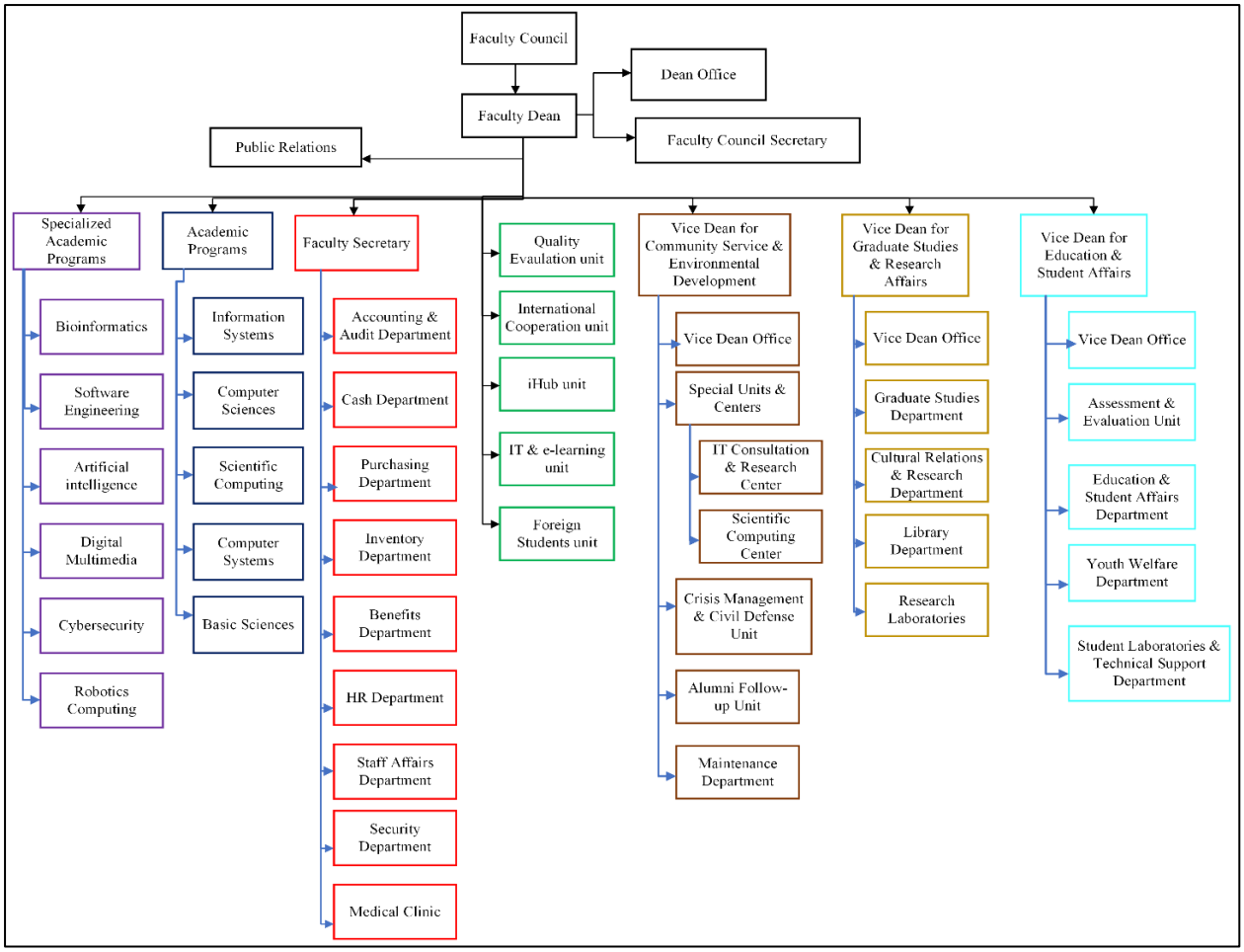

Figure 1 The faculty organizational structure hierarchy

STUDY TIMING AND REGISTRATION

The academic year is divided into two main semesters:

1. The first semester (Fall semester) starts in September and lasts for 15 weeks. Registration for courses takes place within 3 weeks before the start of the semester.
2. The second semester (Spring semester) starts in February and lasts for 15 weeks. Registration for courses takes place within a week before the start of the semester.

There may be also a summer semester which is an intensive semester. The duration of summer semester is not less than 7 weeks with a maximum of 9 credit hours per week, and the student may enroll in a maximum of three courses. The summer semester usually starts in July. Registration for courses takes place within a week before the start of the semester.

The maximum credit hours for enrollment in each semester are:

- Up to 21 credit hours for a student with a GPA greater than or equal to 3.
- Up to 18 credit hours for a student with a GPA greater than or equal to 2 and less than 3.
- Up to 14 credit hours or 5 courses for a student with a GPA of less than 2.0.
- No more than 9 credit hours per week are allowed for any student in the summer semester.

- The minimum number of credit hours for registration in the first and second semesters is 9 credit hours. The faculty council may give permission to drop below the minimum registration requirement for reasons of student graduation.
- The maximum number of credit hours for registration in the Fall and Spring semesters is 21 credit hours. The faculty Council may authorize an increase in the maximum registration limit for reasons of student graduation.

Students may substitute a course or withdraw from a course during any semester and before having been evaluated provided that the withdrawal is requested before the sixth week of the semester and the student presents an acceptable excuse for the withdrawal.

Each faculty member is assigned a group of students for whom he or she is accountable as an academic adviser at the start of each academic year, and students can refer to their advisors for any difficulties. Each semester, all students are required to identify the courses they intend to study and to meet with an Academic Advisor. Students are supposed to track their own progress; however, the Academic Advisor uses a degree flow sheet to track each student's progress at registration advising appointments.

The UMS supports registration advising. By the beginning of each semester, a list of available courses is loaded on the student profile. Students can select/unselect courses. Moreover, students can view the account information of their academic advisors. Please see details at www.ums.asu.edu.eg/

For general enquiries concerning enrolment, you must contact your local Student Support/Administrative Office or academic advisor for guidance.

EQUALITY AND DIVERSITY

- Ain Shams University (ASU) is dedicated to promoting equality and diversity on its campus. Equality is guaranteed for all students, regardless of their gender, age, color, disability, and religion.

- ASU supports a safe environment for both working and studying. The university environment must be free of bullying, harassment, and any form of discrimination. Any of the acts will not be permitted, and any complaints will be investigated thoroughly. Anyone who feels being subjected to these acts is encouraged to raise complaints.

- All students are given equal opportunities and access to facilities. Each student receives full support in developing their skills and talents. Selection for training, or other benefits shall be based on aptitude and ability.

PROGRAM MANAGEMENT

- The faculty has its own dedicated space on the University's main website which can be reached at: https://cis.asu.edu.eg/. The site provides various services for students and faculty members by presenting the internal regulations of the bachelor's degree courses.

- A welcome and induction process starts during their first week, where all students are guided to their Course studies. The purpose of induction is to introduce new students to their peers, the academic and support staff, to familiarize them with the access to and use and of facilities and to outline the relevant policies, procedures, rules and regulations.

- Students have sufficient access to technology to make it possible for them to successfully complete the academic year. This is mostly facilitated through fully fledged IT laboratories, and free Wi-Fi facilities.

- Every student is assigned an Academic Advisor who is one of the faculty members and may continue with the student for the whole study duration. The Academic Advisor should follow-up with the student, assist him in selecting courses each semester, and request to place the student under probation for one semester.

- Students will be given a student handbook at the start of their Course study or access to the LMS where a soft copy is available.

- Student support is constantly valued and acknowledged in student end-of-term evaluation questionnaires and verbal feedback.

- Students can also use their official emails to access content, assignment information, quizzes, announcements, and grades via faculty learning management software (LMS) and the University Management System (UMS).

STUDENTS INVOLVEMENT

There are different facilities that ensure students involvement:

- **Students' Affairs Administration**

  The students' affairs administration is chaired by the Vice-Dean for Education and Students' Affairs and is located in the faculty administration building. This administration has representatives who are responsible for the following tasks:
  - Archiving of the students' files.
  - Issuing the students' identity cards.
  - Electronic recording of the students' course registration, add/drop, and withdraw.
  - Processing the students' course evaluation at the end of each semester.
  - Issuing the students' records at the end of each semester.
  - Issuing the students' graduation certificates.
  - Processing the students' appeals and requests.

- **Students' Union**

  The students' union is also under the general supervision of the Vice-Dean for Education and Students' Affairs.

- **Financial Affairs Administration**

  The financial affairs administration is located at faculty administration building, is responsible for issuing the payment orders for the students' tuition fees at the beginning of the academic year.

- **Library**

The faculty has a library which serves students and researchers in various fields. It is on the Ain Shams campus in a separate building, besides the Digital Library to provide an online service for users. The faculty library contains around 4104 books in different computer science branches that serve students and faculty. The student library contains around 1189 English books in the student hall and 2915 English ones in the teaching staff hall. Also, it contains all BSc honors/graduation project documentation. The library keeps them for student reference.

The faculty library enables students and staff to access and borrow the available books. They have the right to borrow one book for a week, renewable for another week if the book is available or not in demand. Students can use the library services six days a week from 9:00 AM to 5:00 PM (Saturday to Thursday).

Students can access the Egyptian Knowledge Bank (EKB): http://www.ekb.eg/ which is an online library archive and resource that provides access to learning resources and tools for educators, researchers, students, and the Egyptians in general. Through it, they gain access to a lot of E-journals, E-books, digital libraries of many publishers such as "Wiley", "Springer", "Elsevier". Moreover, all students can access EKB remotely off-campus at anytime from anywhere on their personal devices. Moreover, all students have emails ending with @cis.asu.edu.eg which give them access to download any number of books on EKB, also any research papers from the available publishers.

ATTENDANCE AND ENGAGEMENT

Teaching Policy

- **Language**: English language should be used for lecturing and exams
- **Course Syllabus**: Each course syllabus should contain course objectives, textbook, outline, material, assessments, grading policy, and outcome. The outline should contain sections covered every week. The staff member should give the module syllabus to the students in the first class.
- **Textbook:** The staff member is free to select/recommend a textbook, but it should be international and available.
- **Attendance**: The student's attendance should not be less than 75% during the course. Otherwise, the student should not be allowed to attend the final exam.
- **Assignments\ Quizzes:** Assignments\ quizzes are given throughout the semester (spelled out in the course syllabus). Before the end of the term, assignment and quiz grades are announced.
- **Exams:** One midterm exam should be given. The midterm exam should be given during the 7th-8th week. The final exam should be a comprehensive exam covering all material.

KEY DATES

Registration for any semester occurs within two weeks of the semester's start date. The fall semester begins in early September. The spring semester begins in early February. There is also a summer semester before the academic year, which begins late June and lasts for 7 weeks. The midterm exam should be given during the 7^{th}-8^{th} week.

COURSE SPECIFICATIONS

HUM216. Professional Ethics & Legal Aspects [2 CH]

Computer crime and ethics, nature of computer crime, criminal and civil law overview, basis for protection against computer crimes, suitability and application of intellectual property to computers, application of patent to computers, copyright and its range of application ownership and third party rights, trade secrets and unfair competition, computer contracts and liability, privacy, viruses and other programmed threats, legal protection against viruses, global information networks and related legal aspects.

HUM110. English Language I [2 CH]

HUM112. English Language II [2 CH]

Co-requisite: **HUM110. English Language I**

The material reflects the stylistic variety that advanced learners have to be able to deal with ; The course gives practice in specific points of grammar to consolidate and extend learner's existing knowledge; Analysis of syntax; comprehension; Skimming and scanning exercises develop the learners skills; comprehension questions interpretation and implication; the activities and games used develop listening; speaking and writing skills through a communicative; functional approach; with suggested topics for discussion and exercises in summary writing and composition.

HUM113. Report Writing [2 CH]

This course aims to give the student the basic rudiments of report writing. The rationale for report writing, the structure of reports, and such details as physical appearance and linguistic style will be discussed. In addition to writing reports, students will also be given supplementary

HUM119. Human Rights and Combating Corruption [2 CH]

The historical background of human rights, constitutions and the protection of human rights, the crisis of rights and public freedoms in contemporary political and global systems, and the political, social, economic and technical reasons for this crisis; evaluation of the role and activities of international organizations in the protection of human rights;
The problem of corruption in Egypt and the economic, administrative, legal and social reasons, the principles of transparency, integrity and the rule of law, the national strategy to combat corruption.

HUM222. Business Administration [2 CH]

Nature, scope, importance & characteristics of business administration - Development of the managerial thought - Business in external & internal environments - Types of institutions - The managerial process - Functions of management planning: planning concept & importance, types of plans, characteristics & contents of the plan, planning stages, budgeting for planning. Organization: organization concept & importance, characteristics of good & effective organization, types of organization structures, centralization & decentralization, span of supervision, delegation of authority, integration among the different units in the organization. Direction & supervision: motivation, communications, leadership & its different types. Control: concept & importance of control, control steps, objectives, actual performance, the deviation, reasons of the deviation, the corrective actions, types of control, internal & external control. Decision - Making: types of administrative decisions, decision - making process & steps, importance of information of decision making - Major functions in different companies: production, marketing, finance, human resources

BSC121. Physics I [3 CH]

Mechanics: physics and measurements, motion in one dimension, vectors, motion in two dimensions, laws of motion, circular motion and its applications, work and energy, potential energy and conservation of energy, linear momentum and collision, rotation of a rigid body, rolling motion, law of gravity. Waves: Oscillatory motions, wave motion, sound waves.

BSC126. Physics II [3 CH]

Co-requisite: BSC121. Physics I

Optics: Superposition of waves, interference, diffraction and polarization. Elect of magnetic field and Faraday's law, electromagnetic waves. Selected topics: Introduction to modern physics and applications, molecules and solids, superconductivity. Field, Gauss's law, magnetic field.

BSC122. Calculus I [3 CH]

The continuity and the differentiability of a real function. Techniques of differentiation. Derivatives of the trigonometric functions. Implicit differentiation. Linear approximations and differentials. Applications of the derivative: Extrema of functions, optimization problems, velocity and acceleration. Integrals: Indefinite integrals, change of variables, definite integrals, the fundamental theorem of calculus, numerical integration. Applications of definite integrals: Areas, solids of revolution, arc length and surfaces of revolution, work, moments and centers of mass. Transcendental functions: Derivative of inverse function, natural logarithm function, exponential functions, inverse trigonometric functions, hyperbolic and inverse hyperbolic functions, indeterminate forms and rule.

BSC124. Electronics [4 CH]

Co-requisite: BSC121. Physics I

Electronic components and basic laws. Principles of circuit-analysis: Dividers, equivalent sources, methods of solutions, circuits with nonlinear resistance, maximum power-transfer, sinusoidal excitation and impedance concept, magnitude and phase-shift of RLC circuits. Frequency response of linear circuits, passive filter types and characteristics. Diode-circuits: half and full-wave rectifiers, Zener regulators and limiters. Transistor circuits: BJT characteristics, types, basic configuration, biasing and load line, equivalent circuits, voltage gain, input and output impedance, coupling, practical circuits, FET circuits: Characteristics, types, basic configuration, switching modes. Operational amplifiers: Principles, basic circuits:

adder, follower, differentiator, integrator, comparator, Schmitt-circuit, special circuits. Active filters: types, characteristics. Oscillators: Relaxation, feedback, RC, LC, and Voltage controlled oscillators. Display elements: Light-emitting-diodes, liquid-crystal displays, and cathode-ray tubes.

BSC125. Calculus II [3 CH]

Co-requisite: BSC122. Calculus I

Techniques of integration: Integration by parts, trigonometric integrals and substitutions, integrals of rational functions, quadratic expressions, tables of integrals, improper integrals. Infinite series: Sequences, convergent or divergent series, positive-term series (basic comparison test, limit comparison test, ratio and root tests), alternating series and absolute convergence, power series, power series representations of functions, Maclaurin and Taylor series, applications of Taylor polynomials. Differential equations: Definition, classifications and terminology, techniques of solution of ordinary first-order first-degree differential equations (separable, reducible to separable, homogeneous, reducible to homogeneous, linear, reducible to linear, exact differential, non-exact differential-integrating factor), applications.

BSC221. Discrete Mathematics [3 CH]

Sets, sequences, algorithms and pseudo codes. Relations and Functions. Boolean Algebra. propositional logic. Proof techniques. Proof by induction. Basic of Counting. Iteration and recursion. Graph and tree representations and properties.

BSC225. Linear Algebra [3 CH]

Bases, vector spaces, and orthogonality. Inner product spaces. Matrix representations of linear systems. Matrix inversion. Linear transformations. Solution of linear systems. Numerical solution of non-linear systems. System transformations. Eigen systems.

BSC123. Probability and Statistics [3 CH]

Discrete probability. Continuous probability. Expectation and deviation. conditional probability. Stochastic Processes. Independence and Bayes' theorem. Random variables. Distribution functions. Moments and generating function. Probability distributions.

Correlation and regression: method of least squares, multiple regression, (linear generalized and rank) correlation.

CIS160. Introduction to Computer Sciences [3 CH]

Computer definition, different computer types, digital computer, analog computer, general-purpose computer, special purpose computer, hybrid computer. Computer organization, computer hardware, input/output units, storage media, computer memory types, arithmetic and logical unit (ALU), computer software, computer programming, computers and networking, software development systems, Information management, database management systems and applications, operating systems. Introduction to programming languages, General form of Pascal program: Expressions: arithmetic expressions. Simple data types: Real, integer, Boolean, character subrange, and enumerated Data types, input and output statements. Conditional control structures: Compound statements, Boolean expressions, IF statements, Case statements. Repetition statements: While statement, repeat statement, For statement.

CIS150. Structured Programming [3 CH]

Co-requisite: CIS160. Introduction to Computer Sciences

Structured program development: Problem solving, decision structures, repetition structures, top-down and stepwise refinement. Subprograms: Procedures, functions. Structured data types: one-dimension arrays, two-dimension arrays. Sets. Records. Files: Text files random handling files. Dynamic data structures (Pointers). Recursion: Recursive functions, towers of Hanoi.

CIS270. Data Structures [3 CH]

Co-requisite: CIS150. Structured Programming

Abstract Data Types (ADT). Stacks: Definition and operations, implementation of stacks with array and records, applications of stacks. Queues: Definitions, implementation of circular queues, applications of queues. Linked lists: Singly linked lists, linked stacks, linked queues, doubly linked lists, application of linked lists. Tree structures, binary trees: binary tree traversals, binary tree search. Searching Definitions, sequential search. Sorting: Definitions, insertion sort, and selection sort. Hashing: Hash functions, perfect Hash functions.

CIS230. Operations Research [3 CH]

Linear programming: Formulations and graphical solution. Algebraic solution: the simplex method and dual-simplex method. Sensitivity analysis. Transportation and assignment problems. Integer programming: cutting-plane algorithms, branch and bound method. Dynamic programming: Examples of the dynamic programming. Models and computations, solution of linear programs by dynamic programs. Project scheduling by PERT-CPM.

CIS250. Object Oriented Programming [3 CH]

Co-requisite: CIS150. Structured Programming

Objects: Object classes and inheritance through, a design example, deriving an object-oriented design. Functional oriented design: Data flow diagrams, structure charts, data dictionaries deriving structure charts, design examples, concurrent systems design. User interface design: User interface design objectives, interface metaphors, WIMP (Window, Icons, Menus, and Pointing) interfaces using color displays.

CIS240. Statistical Analysis [3 CH]

Co-requisite: BSC123. Probability & Statistics

Sampling distributions. Estimation: points estimates, confidence interval estimates (for means, proportions, differences, sums, variances, and variance ratios), maximum likelihood estimates. Hypothesis tests: Null hypothesis, type I and type II errors, level of significance, special tests of significance for large or for small samples, operating characteristic curves, quality control chart, fitting theoretical distributions to sample frequency distributions, goodness of fit.

CIS260. Logic Design [3 CH]

Co-requisite: BSC121. Physics I

Basic logic concepts: Logic states, number systems, Boolean algebra, basic logical operations, gates and truth tables. Combinational logic: Minimization techniques, Multiplexers and de-Multiplexers, encoders, decoders, adders and subtractors, look-ahead carry, comparators, programmable logic arrays and memories, design with MSI, logic families, tri-state devices, CMOS and TTL logic interfacing. Sequential logic: Flip-flops, monostable multi-vibrators, latches and registers, counters, shift registers. Analog to digital conversion, digital-to-analog conversion, data acquisition, microprocessors.

CIS340. Analysis & Design of Algorithms [3 CH]

Co-requisite: CIS150. Structured Programming

Algorithm concept. Analysis and complexity. Design methods: Divide and conquer: The general method, binary search, merge sort, quick sort, selection, matrix multiplication. Greedy method: The general method, minimum spanning Trees. Dynamic programming: The general method, shortest paths, optimal search trees, and the traveling salesman problem. Backtracking: The general method, The 8-queens Problem. NP-hard and NP-complete problems: Cook's theorem, NP-hard graph problems.

CIS243. Artificial Intelligence [3 CH]

Co-requisite: CIS150. Structured Programming

Artificial and Human intelligence: Domains of AI-symbolic processing: Semantic nets, modeling, model-based reasoning, frames. Inference techniques: Implication, forward and backward chaining, inference nets, predicate logic, quantifiers, tautology, resolution, and unification. Rule based systems: Inference engine, production systems, problem solving, planning, decomposition, and basic search techniques. AI languages: Symbolic and coupled processing prolog: Objects and relations, compound goals, backtracking, search mechanism, dynamic databases, Lisp: program structure and operations, functions, unification, memory models. Fields of AI: heuristics and game playing, automated reasoning, problem solving, computational linguistics and natural language processing, computer vision, robotics. AI based computer systems: Sequential and parallel inference machines, relation between AI and artificial neural nets, fuzzy systems, neural networks.

CIS220. Computer Organization & Architecture [3 CH]

Co-requisite: CIS260. Logic Design

Basic computer organization and design: Computer instructions and their codes, timing and control, execution of instructions. Input, output and interrupt. Assembly language: Programming loops, programming arithmetic & logic operations, subroutines, I/O programming. Central processor organization: Processor bus organization. Arithmetic logic unit, stack organization. Instruction formats. Addressing modes. Data transfer and manipulation, program control. Micro-program control organization: Control memory. Address sequencing. Arithmetic processor design and algorithms: Comparison and subtraction of unsigned binary numbers, addition and subtraction algorithms, multiplication and division algorithms. Input/output organization: Peripheral devices, asynchronous data transfer, direct memory access. Memory organization: Auxiliary memory, virtual memory, cache memory, memory management hardware. Pipeline and vector processing. Multiprocessors.

CIS353. Operating Systems [3 CH]

Co-requisite: CIS220. Computer Organization & Architecture

Introduction Operating system structures: System components, operating system services, system structure, virtual machines, system design and implementation, system generation. Concurrent processes: Process concept, the producer/ consumer problem, the critical section problem, semaphores, language constructs, inter-process communication. CPU scheduling: Scheduling concepts, performance criteria, scheduling algorithm. Memory management: Multi programming with fixed partitions, multiprogramming with variable partitions, paging, segmentation. Secondary storage management: Physical characteristics, device directory, free space management, allocation methods, disk scheduling. File systems: File concept, access methods, directory systems, file protection.

CIS280. Database Management Systems [3 CH]

Co-requisite: CIS150. Structured Programming

An overview of database management; what is a database system, operational data, data independence, relational systems and others. Architecture of a database system: The three levels of architecture, the external level, the conceptual level, the internal level, mappings, the database administrator, the database management system. The internal level: Database accesses, page sets and files, indexing. Hashing, pointer chains, comparison techniques. An overview of DB2: Relational databases, the SQL language, major system components. Relational algebra: A syntax for the relational algebra, traditional set operations, special relational operations. Relational calculus: Tuple-oriented relational calculus, relational calculus vs. relational algebra, domain-oriented relational calculus, query-by-examples. Data definition: Base tables, indexing. Data Manipulation: Simple queries, join queries, built-in functions, advanced features, update operations. The system catalog: Querying the catalog, updating the catalog. View: View definition, DML operations and view, logical data independence, advantages of views. Embedded SQL: Operations not involving cursors, operations involving cursors, a comprehensive example, dynamic SQL. Database environment: Recovery and concurrence security and integrity, database product family.

CIS290. System Analysis & Design [3 CH]

Co-requisite: CIS280. Database Management Systems

Fundamental concepts, system definition, user definition, the different types of users, communication gap, system analyst, system management, structure system analysis, system analysis tools data flow diagram (DFD), data dictionary, English structure, decision tables, decision trees. The system life cycle, problem definition and modules, feasibility studies. Source and destination of data, stores, development plan, analysis phase, IPO chart, generating alternatives. Design methods, automation boundary, alternative implementations, system flow chart, system components, cost/benefit analysis, implementation schedule, physical elements, programs, files, manual procedure and training, forms. Analysts recommendation, logic of the process, detailed design, identifying options, system control program, screens, reports and files, test plan, implementation and maintenance.

CIS380. Software Engineering [3 CH]

Co-requisite: CIS150. Structured Programming

Introduction: Well-engineered software, the software process, software evolution, and software reliability. Human factors in software engineering: Human diversity, knowledge processing, group working. Software specification and system modeling: The software requirements document, requirements evolution, system contexts, viewpoint analysis, model description, real-time system modeling, data modeling. Requirements definition and specification: Requirements specification, nonfunctional requirements definition. Requirements validation and prototyping: The prototyping process, prototyping techniques. Formal specifications, algebraic specification. Model based specification. Software design: Top-down design, systems design, design decomposition, software design quality, design description languages.

CIS365. Computer Networks [3 CH]

Co-requisite: CIS160. Introduction to Computer Sciences

Introduction: The use of computer networks, network structure, network architecture, the ISO reference model, examples of networks. Network topology: Connectivity analysis, delay analysis, backbone design, local access network design. The physical layer: The theoretical basis for data communication, the telephone system, transmission and multiplexing, terminal handling errors. The data link layer: Elementary data link protocols, sliding window protocols, analysis of protocols. The network layer: Virtual circuits and datagrams, routing algorithms,

satellite packet broadcasting. Local networks: Carrier sense networks, ring networks, shared memory systems. The transport and session layers: Transport protects design issues, interconnection of packet-switching networks. The presentation layer: network security and privacy, text compression, virtual terminal protocols, file transfer protocols. The application layer: Distributed database systems, distributed computations.

PRO400. Project [6 CH]

Students are allowed to choose among a number of projects suggested by the different staff members. The general aim of the project is to allow each student to integrate all the disciplines he has studied in a unified chunk of knowledge. On the behavioral side, students are allowed to work in a team so as to practice working in a collaborative environment. This emphasizes also a proper documentation and presentation procedure.

CSY 330. High Performance Computing [3 CH]

Co-requisite: CIS353. Operating Systems Organization of high-performance computer, shared vs. distributed memory, Flynn's taxonomy, Memory issues o Multiprocessor caches and cache coherence o Non-uniform memory access (NUMA), Topologies, Interconnects, Clusters, Resource sharing (e.g., buses and interconnects), Evaluating communication overhead, Data management o Cache effects (e.g., false sharing), Calculate the implications of Amdahl's law for a particular parallel algorithm, Describe how data distribution/layout can affect an algorithm's communication costs, design methods of parallel programming, programming in MPI and OpenMP and algorithms in high performance computing.

CSY350. Embedded Systems [3 CH]

***Co-requisite*: CSY340. Microprocessors & Interfacing** The course presents knowledge of the fundamental principles embedded systems design, explain the process and apply it. It Demonstrates the microcontroller technology both for hardware and software; Analog and Digital Peripherals programming: Digital I/Os, Timers, ADC and Communication Peripherals and how to Design and implement a complete embedded system based on microcontrollers. It also provides microcontrollers' peripherals and Interrupt mechanisms.

CSY340. Microprocessors and Interfacing [3 CH]

***Co-requisite*: CIS220. Computer Organization & Architecture** Advanced topics in microprocessors: superscalar architecture, very long instruction word (VLIW) architecture, multithreaded and multi-core processor. I/O interfacing: isolated and memory-mapped addressing and buffering. Vectored and prioritized interrupts. Direct memory access. Asynchronous and synchronous serial communication protocols: UART, I2C, SPI and USB.

CSY420. Real-Time Systems [3 CH]

***Co-requisite*: CSY350. Embedded Systems** The course provides an integrated approach to developing real time systems with hardware, software, sensors, actuators, controllers and networking. Students will learn to develop a programmable embedded platform, interface a variety of sensors and actuators for interactive systems Real Time Communication: Controller Area Network, LIN, FlexRAy, and Real-Time Ethernet. It also presents Real-time principles of Multitasking, scheduling, and synchronization. Fixed and Dynamic Priority Scheduling algorithms. Synchronization mechanisms and problems: Priority inversion, starvation, deadlocks.

CSY360. Parallel and Distributed Architectures [3 CH]

***Co-requisite*: CSY330. High Performance Computing** The parallel architecture from the standpoint of applications, whereas the Architecture and Organization knowledge area presents the topic from the hardware perspective. Multicore processors, Symmetric multiprocessing (SMP), SIMD, vector processing, Instruction level support for parallel programming, GPU, co-processing, Characterize the kinds of tasks that are a natural match for SIMD machines, Describe the advantages and limitations of GPUs vs. CPUs. Performance evaluation and optimization techniques. Scheduling and contention, the impact of scheduling on parallel performance.

CSY320. Data Communication [3 CH]

***Co-requisite*: BSC125. Calculus II** Analog and digital signals. Signal encoding methods. Transmission impairment. Communication performance metrics. Analog to digital and digital to analog conversion. Bandwidth utilization: multiplexing and spectrum spreading approaches. Transmission media: wired and wireless. Circuit and packet switching. Error detection and correction. Data link layer protocols: addressing, framing, flow and error control. Media access control: random access, controlled access and channelization. Data link protocol examples: ethernet and IEEE 802.11 protocols.

CSY410. Computer and Network Security [3 CH]

***Co-requisite*: CIS365. Computer Networks** Security Principles. Attack and protection models. Symmetric and asymmetric cryptography. Key management and distribution. Authentication and digital signature. Message authentication codes. Network Security: transport layer security (TLS), firewall and intrusion detection systems, web security, wireless network security.

CSY430. Wireless Networks [3 CH]

***Co*-requisite*:* CIS365. Computer networks**, **CSY320. Data Communication** The course gives the fundamentals of the wireless communications systems, the wireless network architectures, protocols, and applications. Topics of study include an overview of wireless communications and mobile computing systems, signal propagation characteristics of wireless channels, wireless channel modelling, frequency reuse/cellular/microcellular concepts, spread-spectrum modulation for wireless systems, multiple access techniques, and wireless networking standards (e.g., 2.5G, 3G, IEEE 802.11, IEEE 802.15, IEEE 802.16/WiMAX).

CSY440. Embedded Systems Networks [3 CH]

***Co-requisite*: CSY340. Microprocessors and Interfacing** Networking of embedded devices differs from other networks from various aspects. Very stringent power constraints, computation limitations, and short-range wireless connections of these devices acquire dedicated efficient networking protocols to satisfy the application requirements. In this course, prominent protocols, mechanisms, and services in various networking layers for NES are discussed. It includes applications, characteristics of the physical layer, medium access control mechanisms, routing and data dissemination, and services such as synchronization and localization.

CSY450. Pervasive computing [3 CH]

***Co-requisite:* CIS150. Structured Programming** Pervasive computing is how computing will be used in the future. It is about moving beyond the traditional desktop computing model, into embedding computing into everyday objects and everyday activities. This course provides software infrastructure for pervasive computing that can support the integration between our physical space and virtual computing space, sensors and sensor network that can capture and

disseminate context information, context-aware applications that use context information to create intelligent everyday objects and applications, embedding computing into everyday objects, user interfaces. Security and privacy to protect access to user context information. Migration where an application context can migrate from one computing environment to another computing environment.