برنامج الحوسبة والمعلوماتية الحيوية – كلية الحاسبات والمعلومات

وصف البرنامج:

المعلوماتية الحيوية هي استخدام تكنولوجيا المعلومات في مجال البيولوجيا الجزيئية. المعلوماتية الحيوية الآن ينطوي على إنشاء وتطوير قواعد البيانات ، و الخوارزميات ، و الأساليب الإحصائية و الحسابية ، ونظرية لحل المشاكل الرسمية والعملية الناجمة عن إدارة وتحليل البيانات البيولوجية. ومن الأنشطة في المعلوماتية الحيوية إعداد الخرائط وتحليل تسلس ل الحمض النووي والبروتينات ، و التوفيق بين مختلف تسلسل الحمض النووي و البروتين مقارنة بينها و خلق و مشاهدة نماذج ثلاثية الأبعاد من هياكل البروتين . برنامج الحوسبة والمعلوماتية الحيوية يقدم خريج كفء لتصميم وتنفيذ ما يحتاجه البيولوجيين والأطباء من برامج حوسبة تستطيع تحليل ماهو متاح من بيانات بيولوجية للوصول لنتائج علمية مذهلة في فترات زمنية مقبولة وموارد تكنولوجية بسيطة في مجالات الحوسبة الحيوية والتنقيب داخل البيانات البيولوجية وتطوير الخوارزميات البيولوجية وتحليل النتائج البيولوجية.

التقدم للبرنامج:

يستقبل هذا البرنامج طلاب الثانوية العامة علمي رياضة وعلمي علوم وما يعادل الثانوية العامة من الشهادات الأخرى. علي أن يكون الالتحاق بالبرنامج بالنسبة لطلاب علمي رياضة عن طريق مكتب التنسيق ، أما طلاب علمي علوم فيتم قبولهم عن طريق التحويلات من مكتب التنسيق بشرط أن يكون المتقدم حاصل علي الحد الأدنى لدرجات القبول لقطاع الحاسبات والمعلومات مع العلم أنه يستلزم لطلبة علمي علوم النجاح في مقرر رياضة ٢- الخاص بالثانوية العامة ويلزم لذلك حضور المقرر التأهيلي لرياضة ٢-.كما يستلزم لطلبة علمي رياضة النجاح في مقرر الأحياء الخاص بالثانوية العامة ويلزم لذلك حضور المقرر التأهيلي للأحياء .مع العلم أنه يتم دراسة المقررات التأهيلية فى الكلية بعد الالتحاق بها.

الامتيازات التى يقدمها البرنامج:

١- إعداد خريجين لهم القدرة العالية على المنافسة فى المؤسسات المحلية والاقليمية فى تخصص الحوسبة والمعلوماتية الحيوية.
٢- طرح برنامج متخصص بالتعاون مع متخصصين في المجال من الجامعات المرموقة مما يتيح تقديم تخصصات تكنولوجية حديثة ويسمح للطلاب باستكمال دراستهم فى جامعات عالمية.
٣- توفير مساحه اكبر للطلاب للتدريبات العملية والمعملية التى تواكب متطلبات العمل فى جميع مؤسسات الدولة.
٤- تزويد الطلاب بالمهارات والمعارف التالية:
- تزويد الطلاب بالمهارات الاساسية لتحليل وتطوير قواعد بيانات المعلوماتية الحيوية.
- استخدام احدث الاساليب والادوات في تحليل وتصميم انظمة الحوسبة الحيوية
- اكتساب مهارات التعامل مع البيولوجيين لاستخلاص احتياجاتهم الفعلية
- الالمام بالعمليات وخطوات ومنهجيات تطوير النظم.
- اكتساب مهارة برمجة الانظمة باستخدام لغات البرمجة المختلفة والعمل بنظم تشغيل مختلفة.

تكلفة البرنامج:

يتطلب الحصول على البكالوريوس أن يجتاز الطالب بنجاح ١٣٦ ساعة معتمدة وذلك على مدي ثمانية فصول دراسية على الأقل، مقسمة إلي أربعة اعوام دراسية وكل عام ٣٤ ساعة. وتكلفة الساعة الدراسية 300 جنية

الوظائف فى سوق العمل:

خريج برنامج الحوسبة والمعلوماتية الحيوية هو خريج قام بدراسة جميع مواد البرمجة ومواد مجال علوم الحاسب ويستطيع أن يعمل في عدة مجالات حديثة وحيوية تضم كأمثلة ولا تقتصرعلى:
١. معاهد الأورام والسرطان ومستشفى سرطان الأطفال حيث تمتلك هذه المؤسسات كم هائل من بيانات التسلسلات التي تحتوي على آلاف الجينات .وتقوم عمليات الحوسبة بتخفيض هذا الكم الهائل من

الجينات إلى بضع أحاد من الجينات ذات الصلة بأقل الموارد وفي وقت زمني قصير .وجدير بالذكر أن تكلفة الكشف علي هذه الجينات بالمعامل البيولوجية تكلفة باهظة للغاية.

٢. -العمل بشركات الرعاية الصحية التي توفر خدمات صحية للعديد من المرضى والتي تحتاج لموظفين محترفين ذو كفاءة عالية ليقوموا بالتعامل مع كم هائل من البيانات البيولوجية والطبية المخزنة في قواعد بيانات كبيرة لتحليلها بدقة وبالتالي تطوير ما يقرره الأطباء والبيولوجيين من برامج حوسبة دقيقة وذو كفاءة عالية.
٣. العمل في مراكز تطوير المحاصيل الزراعية ومقاومة الآفات لاستحداث سلالات ذات إنتاجية عالية عن طريق برامج الحوسبة التي تعمل على استنباط التشابهات والاختلافات بين الجينات ووظائفها المتعارف عليها واستنباط جينات جديدة.
٤. مراكز التدريب الخاصة بالمعلوماتية الحيوية.
٥. العمل كمهندس برمجيات بشركات الحاسبات نظرا لدراسته لجميع مقررات علوم الحاسب الاساسية.

كل ما تم ذكره من مجالات العمل السابقة يحتاج إلى خريج برنامج الحوسبة والمعلوماتية الحيوية لتصميم وتنفيذ ما يحتاجه البيولوجيين والأطباء من برامج حوسبة تستطيع تحليل ما هو متاح من بيانات بيولوجية للوصول لنتائج علمية مذهلة في فترات زمنية مقبولة وموارد تكنولوجية بسيطة.

المستقبل البحثى:

الهدف الرئيسي للمعلوماتية الحيوية هو زيادة فهمنا للعمليات البيولوجية وتركيزها على تطوير وتطبيق تقنيات مكثفة بشكل حسابي (على سبيل المثال ، استخراج البيانات ، وآلة التعلم الخوارزميات ، و التصور) لتحقيق هذا الهدف. من أهم الجهود البحثية في هذا المجال سلسلة الانحياز ، والبحث عن الجينات، وبنية البروتينات و التنبؤ والتوقع من الجينات و البروتينات والتفاعلات بينها، و العوامل الوراثية على نطاق رابطة دراسات ونماذج للتطور. ومجال المعلوماتية الحيوية يؤهل الخريج للعمل في مجالات بحثية حديثة وحيوية مثل : معاهد الأورام السرطانية والهندسة الوراثية وشركات الرعاية الصحية والتي تحتاج إلي خريجين محترفين ذوي كفاءة عالية لديهم القدرة علي التعامل مع كم هائل من البيانات البيولوجية والطبية مع إمكانية العمل في المراكز البحثية الطبية والصحية ومراكز تطوير المحاصيل الزراعية التي تحتاج إلي دقة في إدخال البيانات وبرمجتها بأحدث برامج الحوسبة

المحتوى العلمي:

وتشتمل مقررات اللائحة التالية على القوائم الدراسية المختلفة فى البرنامج موضحا عدد الساعات المعتمدة لكل مقرر، وما يناظرها من الساعات الفعلية للتدريس وما يدعمها من المعامل والتمارين، مع توضيح نوعية هذا المقرر كما هو موضح بالجدول التالى:

الرمز	نوعية المقرر	عدد ساعات تلك النوعية فى البرنامج	نسبة ساعات تلك النوعية في البرنامج	النسب الموجودة في الـ NARS
أ	مقررات انسانية واجتماعية (متطلبات جامعة)	١٢	%٨,٨	%١٠-٨
ب	رياضة وعلوم أساسية	٢٤	١٧,٦	%١٨-١٦
ج	علوم حاسب أساسية (متطلبات كلية)	٣٩	%٢٨,٦	%٢٨-٢٦
د	علوم تطبيقية (متطلبات التخصص)	٤٥	%٣٣,١	%٣٠-٢٨
ه	تدريب ميدانى	٢	%١,٥	%٥-٣
و	مشروع	٦	%٤,٤	%٥-٣
ز	موضوعات تحددها المؤسسة	٨	%٥,٩	%١٦-٤

(NARS) National Academic Reference Standards for Computing and Information

محتويات المقررات

المتطلبات العامة

BHU111 Technical Report Writing

Prerequisite: None

The basic rudiments of report writing; the rationale for report writing; the structure of reports; and such details as physical appearance and linguistic style; In addition to writing reports; student will also be given supplementary exercises as well as applied project to enhance their general writing skills.

BHU131 Human rights

Prerequisite: None

Definition of human rights – historical development of the concept of human rights – culture relativism versus universally accepted human rights standards – various human rights: personal, political, civil, social, economic,…etc. – covering human rights within official international organizations – influence of business and global economic restructuring on human rights – monitoring human rights – human rights violations.

BHU112 Communication & Presentation Skills

Prerequisite: None

Theories of communication – How to translate theories into complete strategies to communicate with diverse audience – Written Communications: Memoranda, Letters, Executive summaries, Business and research reports – Oral Communications: Listening, Presentation skills, Interviewing, Conducting meetings, Interpersonal communication – Negotiation – Intercultural communication – Importance of communication in team building.

BDS121 Fundamentals of Economics

Prerequisite: None

Concept of economics - the economic problem. Theory of demand including: utility theory, theory of production, theory of cost, theory of firm including: pricing theory - Economics of education - Economics of science and technology - Economics of

automation including: computerization.

BDS122 Fundamentals of Management
Prerequisite: None
management and control. Quality management. Management of service industries, accounting History of Management, planning, fundamentals of planning, making decisions, strategic planning, plans and planning tools. Organizing and managing human resources. Influencing, leadership, controlling. Production for risk, and economic analysis.

BHU113 Creative Thinking
Prerequisite: None
Creative thinking allows for going beyond our normal conditioned modes of thinking generating new approaches to problem solving, to see the world from varying perspectives, and to create what we desire for ourselves and our various communities. Applications to be covered will include, among others, communication, problem solving and decision making. This is an opportunity for students to learn how others think differently from themselves, to understand meta-cognition (thinking about
thinking). The course includes Edwarddo Bono's CoRT (cognitive research trust) program of learning thinking, Vertical and lateral thinking approaches and Creative thinking tools like Brainstorming, Tony Buzan's Mind mapping and Edward do Bono's Six Thinking hats.

BHU115 Fundamentals of Sociology
Prerequisite: None
Basic concepts – Basic examination of major theoretical perspectives, Structural functionalism, Symbolic interactionism, conflict theory – Types of Society: Tribal, agrarian, industrial, Post-industrial – Culture – Social networks – Social institutions – Deviance – Education – Religion – Race and ethnicity – Social class – Socialization – Gender identity – Social construction of the family – Community – Health – Social processes – Social change – Social Problems – Social demography.

BHU117 Fundamentals of Environment Science
Prerequisite: None
Studying the Earth; The Dynamic Earth; The Composition of the Earth; Oceans; Atmospheric forces; Astronomy; Change in the biosphere; Ecological Interactions; Biomes; People in the Global Ecosystem; Energy resources; Land & Water resources; Managing human impact.

BDS123 Marketing & Sales
Prerequisite: None
Define marketing; Marketing process; Market analysis: customer base; competition; Best practices and lessons learned; Business research and forecasting tools and techniques; Trend analysis: economics; social; political; environmental; technology; Technology assessment practices and techniques; Presentation skills; Sales and advertising practices; Customer satisfaction strategies; Marketing and branding techniques; Product portfolio analysis; Global trade and international operations; Pricing strategies. Managing marketing through: customer relationships; social responsibility; marketing ethics. It emphasizes E-Commerce Application and Implementation through Business Models and Technology Essentials.

BHU114 Fundamentals of Psychology
Prerequisite: None
Research methods; social and emotional development; neurobiological foundations of behavior; learning; memory; personality; stress and its effect on well-being; abnormal behavior and pathology, and social psychology; Abnormal behavior . It also introduces the general principles of psychology as they are applied to work, relationships, and self. Includes perception, learning, development, motivation, emotion, therapy, communication, attitudes.

BHU118 Social & Human Studies
Prerequisite: None

The aim of the course is: 1) Permit students to meet specific requirements by encouraging them to choose from a broad variety of social and human studies. 2) Learn to utilize theoretical discussions and debate in order to strengthen the professional expertise of a certain special theme and/or to enhance the skill to thematise broader and intertwined cultural and societal issues within and around any field. 3) Foster an appreciation for the humanities.

BHU116 Comparative politics
Prerequisite: None
Central concepts and methods in comparative studies – Political development and democratization – revolution – political culture – Comparison of different countries with respect to the founding principles of: Political system – Electoral system – Parities – Interest organizations – Parliament – Government – Public administration – Policy processes – Political economy. Internationalization.

BHU165 Selected Topics
Prerequisite: None
Topics which are not included in the curriculum and seems to be needed should be suggested as an elective course by CS department.

٢ -متطلبات الكلية

BMA111 Math-1
Prerequisite: None
Sets, Venn Diagrams, Set Memberships of tables, Laws of set Theory, Partitions of sets, Power sets, Propositions and logical operations, Truth tables, Equivalence, Implications, Laws of Logic, Mathematical Induction and Quantifiers, Relations, paths and diagraphs, properties and types of binary relations, Manipulation of relations, closures, Warshall's algorithm, Equivalence and Partial Ordered relations, Posets and Hasse diagram, Lattice, Monoids, Semigroups and groups, Product and Quotients of algebraic structures, Isomorphism, Homomorphism, automorphism,

Normal Subgroups, Codes and group codes, Rings, integral Domains and fields, Ring Homomorphism, algorithms, induction and recursion ; relations and functions ; Graphs, lattices, number systems and codes , Boolean algebra.

BMA112 Discrete Mathematics

Prerequisite: None

Introduces the foundations of discrete mathematics as they apply to computer science, focusing on providing a solid theoretical foundation for further work. Topics include functions, relations, sets, simple proof techniques, Boolean algebra, propositional logic, digital logic, elementary number theory, and the fundamentals of counting.

BMA113 Math-2

Prerequisite: Math-1 (BMA111)

Numbers and Expressions, Linear equations and inequalities, Absolute value equations and equalities, Functions and graphs, Piecewise functions, Graphing equations and inequalities in two variables, Solving linear systems, Linear programming, Linear transformations, , Quadratic functions, Properties of exponents, Polynomial operations – equations, Rational roots, Fundamental Theorem of Algebra, Determinants and Cramer's Rule, Matrix operations Identity and inverse matrices, Symmetric matrices and quadratic forms, Positive matrices, Using matrices to solve systems, Eigen values and Eigen functions.

BST121 Probability and Statistics - 1

Prerequisite: Math–1 (BMA111)

Principles of discrete probability with applications to computing. Basics of descriptive statistics. Distributions, including normal (Gaussian), binomial and Poisson. Least squared concept, correlation and regression. Statistical tests most useful to software engineering: t-test, ANOVA and chi-squared. Design of experiments and testing of hypotheses. Statistical analysis of data

from a variety of sources. Applications of statistics to performance analysis, reliability engineering, usability engineering, cost estimation, as well as process control evaluation.

BST122 Probability and Statistics – 2
Prerequisite: Probability and Statistics – 1 (BST121)
Types of statistics, Population versus sample, basic terms - numerical descriptive measures for populations and samples, for ungrouped and grouped data: Measures of Central Tendency, Measures of Dispersion, And Measures of Position – sampling distribution for the sample means – sample proportions and sample variations- point and interval estimate for the means, proportions and variance – hypothesis testing – regression and correlation analysis.

BMA214 Math -3
Prerequisite: Math-2 (BMA113)
Limits, Limits at infinity, Continuity, Rates of Change and Tangent Lines, Introduction to Derivatives, Differentiation Techniques - products, quotients and chain rules. Differentiability versus continuity, Higher Order Derivatives, Velocity and acceleration, Implicit differentiation, Derivatives of Trig Functions, Derivatives of Inverses, Derivatives of Inverse Trig Functions, Derivatives of Exponential and Log Functions, Extreme values of functions, Graphing, Extreme value problems (word problems), Mean Value Theorem, Related Rates, Linearization and Newton's Method, L'Hôspital's Rule, Definite Integrals, Estimating with rectangles, Trapezoidal Rule, Simpson's Rule, Ant derivatives, The Fundamental Theorems of Calculus.

BIT111 Electrical Circuits
Prerequisite: None
Basic ideas; Electrostatics; Columb`s law; Gauss law; Potential; Capacitors; Electric current; Resistors; Kirchhoff,s law; Magnetic field and forces; Induction and inductors; Basic circuit theory and circuit analysis; Fundamentals of three phase circuits and transformers.

علوم حاسب أساسية:

BCS111 Fundamentals of Computer Science

Prerequisite: None

This course gives a general introduction to computer and information systems. It highlights the history of the different types of computers. In addition, it covers the different components of computer hardware and software. Moreover, it gives an introduction to networking, internet. Also, this course depicts different ways for algorithm development and representations. On the other hand, it covers the data representation and numbering systems.

BCS112 Programming -1

Prerequisite: Fundamentals of Computer Science (BCS111)

This course introduces the basic programming concepts. It begins with the control statements and the loop statements. It then explains functions, 1D and 2D arrays, dynamic arrays, and recursion. After that, it introduces the creation of composite user defined data types using Structures. It also introduces the classes as a core structure for the object-oriented programming. Additionally, the course briefly mentions the primitive file operations.

BCS213 Programming -2

Prerequisite: Programming -1 (BCS112)

It introduces the concepts of object-oriented programming to students with a background in the procedural paradigm. The course begins with a review of control structures and data types with emphasis on structured data types and array processing. It then moves on to introduce the object-oriented programming paradigm, focusing on the definition and use of classes along with the fundamentals of object-oriented design. It also introduces the structures presented by the Standard-Template-Library (STL) such as vectors, lists, sets … etc. Other topics include an overview of programming language principles, simple analysis of algorithms, basic searching and sorting
techniques, and an introduction to software engineering issues.

BCS214 Data Structures

Prerequisite: Programming -2 (BCS213)
In addition to the traditional representations of Abstract-Data-Types (ADT) of various data structures (such as stacks, queues, linked lists, and trees), this course presents modern implementations of the same structures using the Standard-Template-Library (STL): sets, bags, maps, pairs and iterators. hashing and hash Tables. On the other hand, this course presents numerous sorting and searching algorithms.

BCS221 Logic Design
Prerequisite: Electrical Circuits (BIT111)
Basic logic concepts: Logic states, numbering systems, Boolean algebra, basic logical operations, gates and truth tables. Combinational logic: Minimization techniques, multiplexers and de-multiplexers, encoders, decoders, adders and sub-tractors, comparators, programmable logic arrays and memories, design with MSI, logic families, tri-state devices. Sequential logic: Flip flops, mono-stable multi-vibrators, latches and registers counters.

BCS241 Operating Systems
Prerequisite: Fundamentals of Computer Science (BCS111)
Types of operating systems. Operating Systems structures: system components and services, virtual machines. Process management: CPU scheduling: Scheduling concepts, performance criteria, scheduling algorithm. Memory organization and management for single user and multi-user system. Secondary storage management, Disk scheduling, virtual memory.

BIS211 Database Systems
Prerequisite: Data structure (BCS214)
The main objective of this course is to provide students with the background to design, implement, and use database management systems. Topics Include: Evolution of database management systems, Relational Data Model and Relational Algebra, Structured Query Language, Entity Relationship Modeling and Design, ERM to RM Conversion, Tables-

Normalization, Forms/Reports/Menus Implementation. Upon successful completion of this course, students will have the skills to analyze business requirements and produce a viable model and implementation of a database to meet
such requirements.

BCS251 Software Engineering
Prerequisite: Programming -2 (BCS213)
This course presents a broad perspective of software engineering, focusing on the processes and techniques fundamental to the creation of reliable, software systems. It also presents the agile methods and software reuse, along with coverage of 'traditional' plan-driven software engineering. The course is organized into major parts that include: Process, Modeling, Quality Management, Project Management, and Advanced Topics.

BCS316 Algorithms Analysis & Design
Prerequisite: Data Structure (BCS214)
Algorithm concept: Analysis and complexity. Design methods, divide and conquer, binary search, merge sort, quick sort, selection, matrix multiplication, the greedy method. Dynamic programming: shortest paths, optimal search trees. Graph algorithms. Backtracking. NP-hard and NP-complete problems. Tries. Suffix Trees. Orders and Asymptotic analysis. Recurrence relations.

BCS322 Computer Architecture
Prerequisite: Logic Design (BCS221)
Design of a basic computer; Design concepts of Processors; Design of channels and controllers; Interconnections; Memory structures and design; Memory management; Cache memory systems; Firmware design; Reliability; Testing and fault tolerance; CISC computers; RISC computers; Computer interfacing; Design of network interface cards; Examples of computer architecture.

BDS211 Introduction to Decision Support Systems
Prerequisite: Fundamentals of Computer Science (BCS111)
Approaches and techniques to construct and implement an effective computer-based Decision Support Systems (DSS). Alternative software development tools or generators of a DSS. The role of computational tools (simulation, optimization, statistical and other quantitative models) and computer information systems (MIS, AI and ES) to support and enhance the capability of the DSS. Discussion and analysis of real life case studies of integrated DSS is stressed throughout the course.

BIT222 Computers Networks
Prerequisite: Math–2 (BMA113)
Definition; Objectives, Topologies; Classifications; Architecture; Standards; Applications; ISO-OSI model; Switching techniques; Flow control; Error detection and Correction; Congestion control; Routing; Internetworking; Public switched data network; ISDN and B-ISDN; Frame relay; ATM

BCS471 Parallel Processing
Prerequisite: Computer Architecture (BCS322)
Interconnection networks. Parallel computing and networks, direct and indirect networks. Parallel structure. Parallel architecture. MPI programming. Collective communication. Multiple communicator. Applications. Threads programming. Multi-nodes clusters. GPU programming.

BCS323 Theory of computations
Prerequisite: Discrete Mathematics (BMA112)
Provide students with understanding of the foundations of theory of computation, including non-regular languages, multi-tape Turing machines, decidability, the halting problem, reducibility, incompressible strings and randomness, winning strategies for games, and complexity theory.

BCS361 Artificial Intelligence

Prerequisite: Programming–2 (BCS213)
This course covers the different methodologies of Knowledge Representations: Predicate Calculus, Structured Representations, and Network Representations. In addition, it introduces the State Space Search using both trees and graphs, heuristic search, model based reasoning, case-based reasoning, and reasoning with uncertain or incomplete knowledge. Moreover, this course gives an overview of AI Application Areas such as strategic planning, game planning, rule-based systems, and (fuzzy) expert systems.

BIT416 Computer Graphics and Data Visualization
Prerequisite: Programming-1 (BCS112)
Introduction to computer Graphics ; Overview of Graphics systems ; Line drawing algorithms ; Circle drawing algorithms ; Ellipse drawing algorithms ; Area filling algorithms ; polygon filling algorithms ; line clipping algorithms ; Polygon clipping algorithms; Two dimensional transformations; (translation-rotation-scaling-general transformations-composite transformations); Three dimensional object representation and projections ; three dimensional modeling and transformations(translation-rotationscaling-sheer-reflection-composite) ; Three dimensional Viewing and Camera Model. Visible surface detection algorithms; Reflection and illumination models; Rendering algorithms for 3-D object; parametric representation of 3-D objects. Visual representation methods and techniques that increase the understanding of complex data and models. Emphasis will be placed on the identification of patterns, trends and differences from datasets across categories, space, and time. The ways that humans process and encode visual and textual information will be discussed in relation to selecting the appropriate method for the display of quantitative and qualitative data. Graphical methods for specialized data types (times series, categorical, etc.) are presented. Topics include charts, tables, 3Dgraphics, effective presentations, multimedia content, animation, and dashboard design. Examples and cases will be used from a variety of industries. Lab work will be on the visualization toolkit (VTK).

BIS421 Knowledge Discovery

Prerequisite: Programming-2 (BCS214)
Knowledge discovery in databases, Data mining process, Data cleaning and preparation, Mining association rules, Classification, Prediction, Clustering, Web mining, Applications of data mining, Mining advanced databases.

BIT441 Image Processing
Prerequisite: Computer Graphics and Data Visualization (BIT416) Digital image Fundamentals ; Image enhancement in the spatial domain : grey level transformation ; Histogram processing ; Spatial filters ; Image enhancement in frequency domain : 2-D Fourier transform ; Other transforms ; Smoothing filters ; Sharpening filters ; Geometric transformations ; image segmentation : detection of discontinuities ; edge linking and boundary detection ; Thresholding ; Region based segmentation ; Morphological image processing : operation concepts ; some basic algorithms.

BCS472 High Performance Computing
Prerequisite: Parallel Processing (BCS471)
An in-depth study of the state of theart in high performance computing. Topics include parallel computer architectures, programming paradigms, and their applications. Parallel architectures include PC clusters, shared-memory multiprocessors, distributed memory multiprocessors, and multithreaded architectures. Parallel programming paradigms include message passing interface (MPI), its second generation MPI-2, and multithreaded programming. Applications include computational science and high performance Web and database servers for Internet-based electronic commerce and Bioinformatics. Map reduce computation. Cloud computing.

متطلبات التخصص علوم تطبيقية:

BIO251 Biology-1
Prerequisite: None
This course should cover the basics of the biological science. It introduces the Tree of Life. It then covers the cell structure and function, the cell division. Moreover, Genetics are covered

including the DNA, the Gene Expression, the Central Dogma of molecular biology including the Transcription and Translation processes. Also, the course highlights the different Genome Sequencing techniques. The Evolutionary Process is also explained.

BIO252 Biology-2
Prerequisite: Biology-1 (BIO251)
This course focuses on the basic principles of biochemistry, genetics, molecular biology, and recombinant DNA technologies. The material presented introduces modern biology at the molecular level: the structure and function of biological macromolecules, the basics of cellular metabolism, meiosis and inheritance, DNA replication, the basics of gene expression, and general recombinant DNA techniques.

BIO261 Organic Chemistry-1
Prerequisite: None
This course will begin with a basic review of some of the important concepts established in inorganic chemistry. The chemistry of carbon compounds will be distinguished from inorganic chemistry. Fundamental concepts of the various classes of aliphatic and aromatic compounds will be examined. Fundamental concepts of hydrophobicity and hydrophilicity will be studied. Basic concepts of Biochemical and physiological analogies will be evident.

BIO262 Organic Chemistry-2
Prerequisite: Organic Chemistry-1 (BIO261)
This course introduces functional groups with emphasis on alcohols, phenols, ethers, aldehydes, ketones, amides, esters, amines, and carboxylic acids. Once the nature and reactivity of these functional groups is understood, the more important biological examples will covered. Biochemistry, particularly the properties and metabolism of biological macromolecules such as nucleic acids, lipids, and proteins will be introduced.

BIO316 Biochemistry
Prerequisite: Biology-2 (BIO252)
Fundamental concepts in biochemistry and molecular biology will be covered in this course. These concepts include structure function relationships, reactivity, thermodynamics, gene expression. The function of biochemical macromolecules will be directly related to their structure. In addition, the three-dimensional structures of proteins, nucleic acids, polysaccharides and membranes are each explored in the context of their functions and their microenvironments within living organisms. The course also covers the DNA replication and the RNA and protein synthesis. The course also explains how protein synthesis can be controlled at the level of transcription and translation, and summarizes what is currently known about the biochemical basis of cancer.

BIO352 Molecular and Cell Biology
Prerequisite: Biology-2 (BIO252)
Basics of the structure and function of cells and cell organelles, cell growth and division, motility, cell differentiation and specialization. Molecular basis of biological processes, emphasizing gene action in context of entire genome. Chromosomes and DNA metabolism: chromatin, DNA replication, repair, mutation, recombination, transposition. Transcription, protein synthesis, regulation of gene activity. Procaryotes and eucaryotes.

BIO353 Genetics
Prerequisite: Biology-2 (BIO252)
An introduction to the principles of heredity in diploid organisms, fungi, bacteria, and viruses. Mendelian inheritance; population genetics; quantitative genetics; linkage; sex determination; meiotic behavior of chromosome aberrations, gene structure, regulation, and replication; genetic code. Emphasis is on molecular genetics.

BIO451 Neural Networks and Learning Machines
Prerequisite: Math-3 (BMA214)

Neural network concepts: Basic definition, connections, processing elements. Feedforward neural networks (non-recurrent neural networks). Back-propagation Learning- Algorithm. Delta Rule. Scaling and Biases. Performance Issues. Associative memories. Heteroassociative, autoassociative and interpolative memories. Bi-directional associative memories. Counter propagation neural networks. Extreme Learning Machines. Support Vector Machines and Kernels. Kernel definition. Applications in Bioinformatics.

BIO452 Genetic Algorithms

Prerequisite: Math-3 (BMA214)

Canonical Genetic Algorithm. Basic operators. Selection, Crossover and Mutation. Fitness functions. Replacement strategies. Floating point representations. Uniform and non-uniform mutations. Function optimization. Schema theory. Genetic programming. Tree representations. Applications. Fuzzy logic. Fuzzy rule-based systems. Evolution of fuzzy systems. Genetic learning of neural networks. Feature selection. Clustering using genetic algorithms. Evolution Strategies. Applications in Bioinformatics.

BIO454 Bio-computing

Prerequisite: Biology-2 (BIO252)

This course provides an introduction to the features of biological data, how that data are organized efficiently in databases, and how existing data resources can be utilized to solve a variety of biological problems. Relational databases, object oriented databases, ontologies, data modeling and description, survey of current biological databases with respect to above, implementation of a database focused on a biological topic. Biopython and Bioperl and R programming.

BIO455 Bioinformatics

Prerequisite: Biology-2 (BIO252)

This course will provide an overview of bioinformatics, the application of computational methods to analyse the rapidly expanding amount of biological information. Following the

natural flow of this information in the cell, the course will begin with the analysis of gene sequences and progress to the study of protein structures. The classic dynamic programming method of sequence alignment will be
presented first, and then it will be shown how this can be extended to allow rapid searching and scoring of the thousands of sequences in a genome. This will naturally lead to the question of how large amounts of biological information can be intelligently organized into a database. Discussion of sequence-structure relationships will form the bridge to protein structure. Particular emphasis will be placed here on statistically based "predictions" of secondary structure. For the analysis of 3D structures, mathematical constructions, such as Voronoipolyhedra, will be presented for calculating simple geometric quantities, such as distances, angles, axes, areas, and volumes. Finally, it will be shown how these simple quantities can be related to the basic properties of proteins and this will naturally lead to a brief overview of the more physical calculations that are possible on protein structures, namely molecular dynamics and Monte Carlo simulation. Microarray analysis. Clustering and Trees.

BIO456 Biological Sequence Analysis
Prerequisites: Biology-2 (BIO252), Algorithm Analysis and Design (BCS316)
This course covers the fundamentals of the analysis of nucleic acid and protein sequences, with an emphasis on the application of algorithms to biological problems. Topics include sequence alignments, database searching, comparative genomics, and phylogenetic and clustering analyses. Pairwise alignment, multiple alignment, DNS sequencing, scoring functions, fast database search, comparative genomics, clustering, phylogenetic trees, gene finding/DNA statistics.

BIO457 Computational Biology
Prerequisites: Biology-2 (BIO252), Algorithm Analysis and Design (BCS316)
This course is introduced to understand the major issues concerning the algorithmic analysis of genomes, sequences and structures. Various existing methods will be critically described and the strengths and limitations of each will be discussed. The course starts covering the modern genome projects, the genome/protein sequence databases, and the motif databases. After that, the

sequence alignment and sequence similarity search techniques will be studied. The course also refers to techniques of Protein Structure Prediction. Students are also expected to study the Gene Regulatory Signals/Modules/Networks. Next, genome-related topics like Genome Variation and Genome-Wide Association Studies will be covered. Finally, techniques related to the Metabolic Pathways will be highlighted.

BIO461 Biophysics
Prerequisite: Biology-2 (BIO252)
The course provides a general introduction to quantitative aspects of biological processes and the underlying physical principles. Among the key topics covered in the course are the following: transport processes and rates of biochemical/biophysical reactions (including enzyme kinetics), structure and function of biological macromolecules and macromolecular assemblies, bioenergetics, protein synthesis, mechanism of inheritance, some commonly used experimental techniques in
biophysics.

BIO463 Machine Learning and Bioinformatics
Prerequisites: Bioinformatics (BIO455), Neural Networks and learning Machines (BIO451)
This course covers the basic applications of machine learning and modeling techniques to biological systems. Topics include gene structure, recognition of DNA and protein sequence patterns, classification, and protein structure prediction. Pattern discovery, Hidden Markov models/support vector machines/neural network/profiles. Protein structure prediction, functional characterization or proteins, functional genomics/proteomics, metabolic pathways/gene networks.

BIO464 Mathematical Biology
Prerequisites: Biology-1 (BIO252), Math-3 (BMA214)
Population dynamics. The Lotka-Volterra predator-prey equations, evolutionary game theory, mathematical epidemiology. Modeling of neurons and carcinogensis. Mechanics of biological tissues. Theoretical enzymology and enzyme kinetics. Cancer modeling and simulation.

Modeling movement of interacting cell populations. Mathematical modeling of scar tissue formation. Mathematical modeling of intracellular dynamics. Modeling physiological systems. Modeling of arterial disease. Multi-scale modeling of the heart. Traveling waves in a wound-healing assay. Swarming behavior. The mechanochemical theory of morphogenesis. Biological pattern formation and BioStatistics.

BIO465 Genomics and Proteomics

Prerequisites: Bioinformatics (BIO455)

The course gives an overview of the fundamental concepts of the fields of genomics and proteomics. Genomics is the study of the functions and interactions of the genes in a genome whereas proteomics is defined as the study of all the proteins expressed by the genome. The genome and the proteome are intimately linked between a complex pathway of transcription and translation, which principally involves mRNA processing, protein folding and posttranslational modifications. Both genomics and proteomics incorporate areas of biotechnology, bioinformatics and biology, and utilize a multitude
of methods and techniques to study gene and protein expression profiles of cells and whole biological systems.

BIO466 Structural Bioinformatics

Prerequisites: Bioinformatics (BIO455)

This course introduces the practical application of structure analysis, database searching and molecular modeling techniques to study protein structure and function. The basic concepts of macromolecular structure are reviewed together with secondary structure calculation and structure-alignment approaches as well as molecular visualization software, and web-based tools. The student will gain practical knowledge in using software techniques to: handle and compare structural information, search the Protein Data Bank site, analyze protein structure and generate 3D structures on the basis of homology.

BIO470 Systems Biology

Prerequisite: Biology-2 (BIO252)
This course focuses mainly on the development of computational models and their applications to diverse biological systems. Because the biological sciences have become so complex that no individual can acquire complete knowledge in any given area of specialization, the education of future systems biologists must instead develop a student's ability to retrieve, reformat, merge, and analyze complex biological information. This course provides the student with the background and mastery of methods to execute standard systems biology tasks, understand the modern literature, and launch into specialized courses or projects that address biological questions using theoretical and computational means.

BIO471 Data Mining & Bioinformatics
Prerequisite: Biology-2 (BIO252), Database Systems (BIS211)
This course covers theory, algorithms, and methodologies of data mining technologies, providing a comprehensive discussion of data-intensive computations used in data mining with applications in bioinformatics. This course offers authoritative coverage of data mining techniques, technologies, and frameworks used for storing, analyzing, and extracting knowledge from large databases in the bioinformatics domains, including genomics and proteomics. It begins by describing the evolution of bioinformatics and highlighting the challenges that can be addressed using data mining techniques.

BIO498 Project
Prerequisite: Biology-2 (BIO252)
The project is an application of biological and computational techniques studied. The student should use biological databases in different aspects of bioinformatics for the purpose of classification, prediction, identification of genes, analysis of metabolic pathways, analysis of protein structures, design of ontologies, visualization of 3D structures, mining of data or ontologies, establishment of expert systems for analysis of diseases and cancer. An implementation of web servers is an asset.

معامل متخصصة:

BLA001 Biostatistics Lab

Prerequisite: Probability and Statistics-1 (BST122)

This lab covers basic topics in introductory statistics, including graphs, confidence intervals, hypothesis testing, comparison of means, regression, and designing experiments. It also introduces the principles behind such modern topics as likelihood, linear models, meta-analysis and computer-intensive methods. For most of the statistical techniques covered in this lab, the capabilities of one or more software packages (MINITAB, SAS, SPSS, and NCSS) may be used to perform the calculations needed for their application.

BLA002 Biopython&Bioperl Lab

Prerequisite: Programming-2 (BCS213)

This lab begins with a very basic introduction that teaches the principles of Python/Perl programming languages. It then introduces the Biopython/Bioperl packages, which can be useful in solving life science problems. The lab will provide a wealth of supplementary information, including instructions for installing Python/Perl and Biopython/BioPerl. Next, sophisticated tools for bioinformatics, including relational database management systems and XML are covered. Moreover, applications with source code, such as sequence manipulation, filtering vector contamination, calculating DNA melting temperature, parsing a genbank file, and inferring splicing sites will be
illustrated.

BLA003 Bioserver Implementation Lab

Prerequisite: Programming-2 (BCS213)

Biological Data Servers, or Bioservers, can monitor, analyze, archive and provide realtime remote access to biological systems. They provide baseline data and research opportunities. The main goal of this lab is to develop and implement inexpensive open source bioservers that can be used in various bioinformatics and computational biology studies either in single biomolecule

level or in systems biology level. To implement a bioserver, this lab depends on the open source operating systems (such as Linux) and programming platforms (such as JAVA).

BLA004 Data Analysis for Genomics Lab
Prerequisite: Biology-2 (BIO252)
Matlab and R programming. Next generation sequencing techniques. Epigenetics. DNA methylation microarray analysis. Histone gene expression analysis. Microarrays. Gene expression. Cancer genomics.

BTR481 Field Training
Prerequisite:None – Cannot be taken before passing 50 credit hours. Emphasis is on linking academic study with industry in different fields studied in computing and bioinformatics. Areas of specialization of different training locations will be distributed among students to meet with application needs of industry.

أعضاء هيئة التدريس:

يقوم بالتدريس فى هذا البرنامج نخبة متميزة من اعضاء هيئة التدريس بكليتي الحاسبات والعلوم والجدول التالي يحتوى على قائمة بأعضاء هيئة التدريس بكلية الحاسبات والمعلومات المشاركين فى البرنامج.

م	الإسم	القسم التابع له	الدرجة العلمية	تاريخ الحصول على الدرجة العلمية	عدد الأبحاث المنشورة فى دوريات محكمة	عدد الأبحاث المنشورة فى مؤتمرات محكمة
قسم علوم الحاسب						
١	أ.د. فوزى على السيد تركى	علوم الحاسب	أستاذ متفرغ	١٩٩٨/٩/٢	٧٣	١١٥

٢	أ.د/عربى السيد كشك	علوم الحاسب	أستاذ	٢٠١٤/٧/٢٢	٢٣	٣٠
٣	أ.د/أشرف بهجات السيسي	علوم الحاسب	أستاذ	٢٠١٥/٧/٢٧	٣٠	٤٩
٤	أ.م.د/حمدى محمد موسى	علوم الحاسب	أستاذ مساعد	٢٠١٤/٥/٢٥	١١	١٤
٥	د/شريف سعيد العتربى	علوم الحاسب	أستاذ مساعد	٢٠١٦/٣/١٨	٤	٨
٦	د/جمال فاروق الهادى متولى	علوم الحاسب	مدرس	٢٠٠٧/٤/٢٩	٣	١٠
٧	د/مصطفى عبد الحليم مصطفى	علوم الحاسب	مدرس	٢٠٠٩/٧/٢٧		١
٨	د/هانى محمد سعيد محجوب	علوم الحاسب	مدرس	٢٠١٠/٦/٢٨		٢
٩	د/ محمد محمد نبيل شمس الدين	علوم الحاسب	مدرس	٢٠١٢/١١/٢٦	٧	٦
١٠	د/هبه محمد عاطف البيه	علوم الحاسب	مدرس	٢٠١٢/١٢/٩	–	١
١١	د/محمد المنشاوى سليمان	علوم الحاسب	مدرس	٢٠١٢/١٢/١٦		–
١٢	د/عبد العليم كمال عبد العليم	علوم الحاسب	مدرس	٢٠١٢/١١/٢٦		١
١٣	د/محمود محمد محمود حسين	علوم الحاسب	مدرس	٢٠١٤/٤/٢٨		–
١٤	د/أنس عبد العزيز عبد الرحمن	علوم الحاسب	مدرس	٢٠١٥/٧/٢٧	–	٤
١٥	د/مدحت احمد توفيق عبد الهادى	علوم الحاسب	مدرس	٢٠١٥/٦/٢٩		٥
١٦	د/وليد سعيد عبد الحميد عطوه	علوم الحاسب	مدرس	٢٠١٥/٩/٢٨	١	–
١٧–	د/سامح محمد شهدى محمد	علوم الحاسب	مدرس	٢٠١٦/٦/٢٩		–
قسم نظم المعلومات						
١٨–	أ.د/حاتم محمد سيد احمد	نظم المعلومات	أستاذ	٢٠١٤/١١/٢٤		٩
١٩–	د/عماد سعيد سالم العبد	نظم المعلومات	مدرس	٢٠١٤/١٠/٢٤	٥	٨
٢٠–	د/ رضا محمد حسين مبروك	نظم المعلومات	مدرس	٢٠١١/٩/٢٦	٣	٢

٢١-	د/ حمدى عبد الحميد إبراهيم	نظم المعلومات	مدرس	٢٠١١/١١/٢٨	٢	٦
٢٢-	د/ راشد خليل خليل سالم	نظم المعلومات	مدرس	٢٠١٢/٨/٢٧	٣	٦
٢٣-	د/أميرة عبد الوهاب أحمد	نظم المعلومات	مدرس	٢٠١٢/٨/٢٧	٢	١
٢٤-	د/ وردة إبراهيم أحمد الخولى	نظم المعلومات	مدرس	٢٠١٦/٩/٢٦		–
قسم تكنولوجيا المعلومات						
٢٥	أ.د. محيى محمد هدهود	تكنولوجيا المعلومات	أستاذ متفرغ	٢٠٠١		
٢٦-	أ.م.د/ خالد محمد امين	تكنولوجيا المعلومات	أستاذ مساعد	٢٠١٣/١٢/٢٤		٢
٢٧-	د/ احمد زاهر محمد	تكنولوجيا المعلومات	مدرس	٢٠١١/٨/١٥		٧
٢٨-	د/ على فؤاد محمد سليمان	تكنولوجيا المعلومات	مدرس	٢٠١٣/٧/٢٩	٢	٦
٢٩-	د/ سامح ظريف فهيم شنودة	تكنولوجيا المعلومات	مدرس	٢٠١٥/٥/٢٦		١
٣٠-	د/ نورا عبد المعز السباعى سمرى	تكنولوجيا المعلومات	مدرس	٢٠١١/١١/٢٨	٦	١٨
٣١-	د/ أحمد محمود حماد	تكنولوجيا المعلومات	مدرس	٢٠١٢/٨/٢٧		–
٣٢-	د/ أسامة شبل عبد الغنى	تكنولوجيا المعلومات	مدرس	٢٠١٣/٧/٢٩	١	٤
٣٣-	د/ مينا إبراهيم سمعان	تكنولوجيا المعلومات	مدرس	٢٠١٢/١٠/٣٠	٢	٢
٣٤-	د/ خالد نبيل عبد الواحد إسماعيل	تكنولوجيا المعلومات	مدرس	٢٠١١/٩/٢٦		–
٣٥-	د/ تامر فتحى غانم إبراهيم	تكنولوجيا المعلومات	مدرس	٢٠١٥/٥/٢٦	٢	٤
٣٦-	د/ ريهام صلاح يوسف الهبيان	تكنولوجيا المعلومات	مدرس	٢٠١٦/٤/٢٧		–
قسم بحوث العمليات ودعم إتخاذ القرار						
٣٧-	أ.م.د/أسامة عبد الرؤوف عبد الرحمن	بحوث العمليات	أستاذ مساعد	٢٠١٤/٣/٣١		٣
٣٨-	أ.م.د/ نانسى عباس الحفناوى	بحوث العمليات	أستاذ مساعد	٢٠١٦/٤/٢٧	٨	٢

٣٩-	د/ احمد محمد كفافى	بحوث العمليات	مدرس	٢٠١٤/١/٢٧			-

نظام الدراسة والامتحانات:

يعتمد البرنامج على التدريس بنظام الساعات المعتمدة ١٣٦ ساعة، مقسمة على أربع سنوات دراسية بمعدل فصلين دراسيين ، ويجوز أضافة فصل صيفى حسب الحاجة. الدراسة فى البرنامج باللغة الإنجليزية.

أ - يتم تصحيح امتحان كل مقرر من ١٠٠ درجة.

ب - الحد الأدني للنجاح فى المقرر الدراسي هو ٥٠ % من مجموع درجات المقرر، و ٣٠على الأقل من درجات الإمتحان النهائى.

ج - توزع درجات الامتحان فى كل مقرر على النحو التالي:

الأعمال الفصلية على النحو التالى:

٤٠% للأعمال الفصلية موزعة على- :

-إمتحان منتصف الفصل الدراسي.

-الإمتحانات التى يجريها الأستاذ بصفة دورية والتطبيقات العملية أو الأعمال التى يكلف

بها الطلاب أثناء الفصل الدراسي.

الأختبار النهائى:

٦٠% لامتحان نهاية الفصل الدراسي.

طرق التدريس

١- المحاضرات
٢- المعامل/التمارين
٣- تقارير بحثية
٤- مشروع للمقرر

٥- تعليم ذاتى
٦- سيمنارات
٧- عصف ذهنى

طرق التقييم

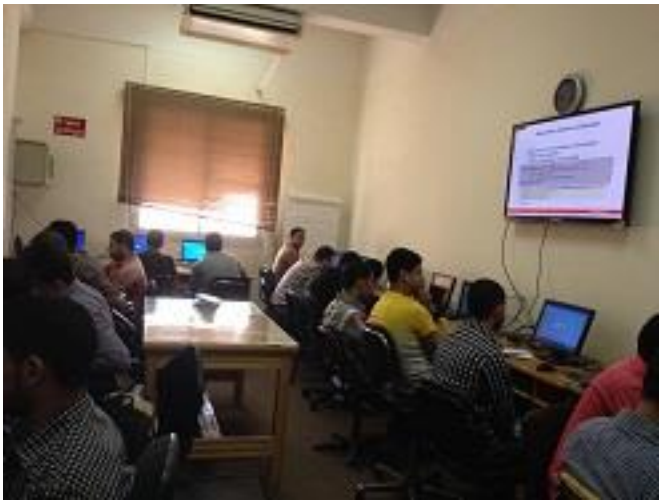
- يتم تصحيح امتحان كل مقرر من ١٠٠ درجة موزعة على الاتى.
١- اعمال السنة ٤٠% موزعة على
-إمتحان منتصف الفصل الدراسى
- امتحان عملى /تمارين
- تطبيقات عملية أو الأعمال التى يكلف بها الطلاب أثناء الفصل الدراسي.
٢- إمتحان تحريرى نهاية الفصل ٦٠%

الإمكانات المادية المتاحة:

- توجد ٤ معامل تخصصية حديثة فى علم الاحياء والكيمياء والكيمياء العضوية بكلية العلوم بجامعة المنوفية بالإضافة لوجود معامل معهد الهندسة الوراثية بجامعة مدينة السادات حيث يتم انتداب تدريس المواد البيولوجية من كلية العلوم والصيدلة وتم الاتفاق فى الجامعة على هذا بالإضافة لمعامل الكلية فى الحوسبة و معالجة الصور وتحليل البيانات الكبيرة.
- يوجد مبنى جديد للكلية يحتوى على ٣ فواصل (مدرجات – معامل – مبنى ادارى) ويحتوى فاصل المدرجات على ٦ مدرجات بسعات مختلفة حيث مدرج ١و٢ بسعة ٢٥٠ – ومدرج ٣و٤ بسعة ٤٠٠ ومدرج ٥و٦ بسعة ٧٠٠ طالب بالإضافة لمبنى فاصل المعامل حيث يوجد ١٥ معمل متخصصة فى الحاسبات بسعات مختلفة

صور المعامل

معامل الحاسبات الشخصية PC Laboratories



معمل الشبكات و الإنترنت Cisco Networking and Internet Laboratory

معمل الرخصة الدولية لقيادة الكمبيوتر (ICDL)

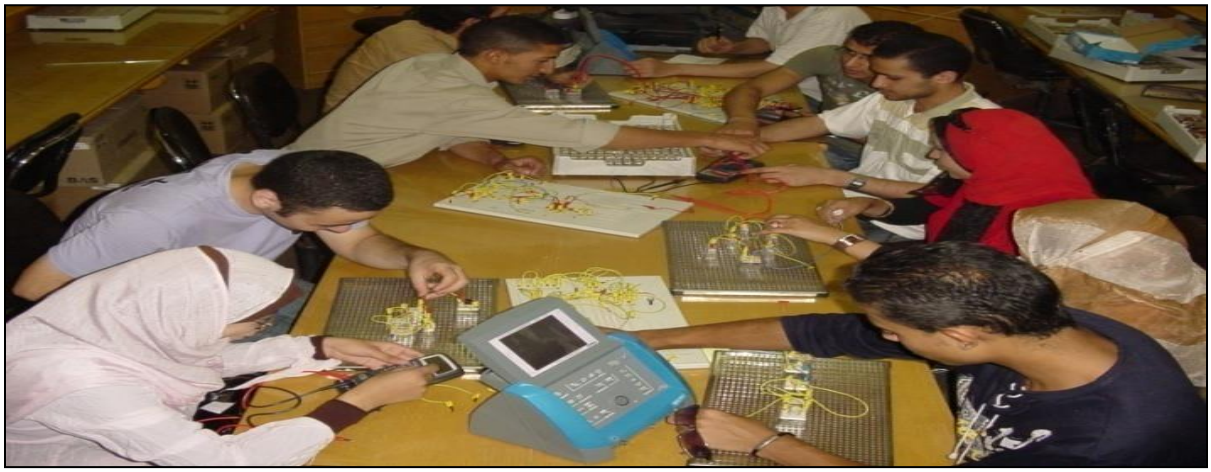
معمل نظم قواعد البيانات Database lab

معمل النمذجة والمحاكاة **Modeling & Simulation** Laboratory

معمل المعالج الدقيق Microprocessor Laboratory

معمل ملحقات الحاسب (الطرفيات) Peripherals Laboratory

معمل العناصر الالكترونية Electronic Devices Lab



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معمل التصميم المنطقى والمبرمجات المنطقية Logic Design & PLD Laboratory


قسم الكيمياء
شعبة الكيمياء الحيوية
معمل الكيمياء الحيوية
Biochemistry Division
Biochemistry Division

١

معمل الوسائط المتعددة Multimedia Laboratory