



Sana'a University



Faculty: Computer and Information Technology

Department: Computer Science

Computer Science Program Specifications

Prepared by:

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Date of preparation

2025

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Head of Department

Dean of the Faculty

Dean of Academic
Development center and
Quality

Rector of Sana'a University

Prof. Al-Qassim Mohammed
Abbas



1. Program Identification and General Information

Scientific name of the program:	Bachelor in Computer Science
Total credit hours required to award the degree	134
Number of years needed for completion of the program:	4 Years
The body responsible for granting the degree:	Computer Science department
The body responsible for the program:	Computer Science department
Award granted on completion of the program:	Bachelor in Computer Science
Study system:	Full Time
Study Language of the Program:	English /Arabic
Entry requirements:	High School degree
Departments participating in the program:	Information System, Information Technology
Starting year of the program:	2007
Study methods in the program:	Class Based
Location of Delivery:	Faculty Campus
The program resources:	
Minimum grade requirements:	50%
Other admission requirements:	
Date of program development:	Sep-2025
Prepared by :	Computer Science Department (QAU)

2. Overview

Computer Science is the study of computers and computational systems. Unlike electrical and computer engineers, computer scientists deal mostly with software and software systems; this includes their theory, design, development, and application.

Principal areas of study within Computer Science include artificial intelligence, computer systems and networks, security, database systems, human computer interaction, vision and graphics, numerical analysis, programming languages, software engineering, bioinformatics and theory of computing.

Although knowing how to program is essential to the study of computer science, it is only one element of the field. Computer scientists design and analyze algorithms to solve programs and study the performance of computer hardware and software. The problems that computer scientists encounter range from the abstract-- determining what problems can be solved with computers and the complexity of the algorithms that solve them – to the tangible – designing applications that perform well on handheld devices, that are easy to use, and that uphold security measures.



3. University Vision, Mission and Goals

3.1 University Vision

تطمح جامعة صنعاء الى الريادة الوطنية في التعليم والتعلم والبحث العلمي وخدمة المجتمع وأن تكون من أفضل الجامعات الإقليمية وبيت الخبرة في اليمن.

3.2 University Mission

الاسهام في جهود التنمية المستدامة من خلال توفير بيئة تعليم عال يحقق معايير الجودة وخدمات بحثية متميزة في ظل شراكة وطنية مثمرة تركز على الشفافية والمهنية والإبداع.

3.3 University Goals

1. إتاحة الفرص الدراسية المتخصصة والمتعمقة للطلبة في ميادين المعرفة المختلفة تلبي احتياجات البلاد من التخصصات والفنيين والخبراء.
2. العناية باللغة العربية وتدريبها وتطويرها وتعميم استعمالها كلغة علمية وتعليمية في مختلف مجالات المعرفة والعلوم وذلك باعتبارها الوعاء الحضاري للمعاني والقيم والأخلاق للحضارة العربية والإسلامية.
3. تطوير المعرفة بإجراء البحوث العلمية في مختلف مجالات المعرفة سواء على المستوى الفردي أو الجماعي وتوجيهها لخدمة احتياجات المجتمع وخطط التنمية.
4. الاهتمام بتنمية التقنية "التكنولوجيا" وتطويرها والاستفادة منها في تطوير المجتمع.
- 5-تشجيع حركة التأليف والترجمة والنشر في مختلف مجالات المعرفة مع التركيز بوجه خاص على التراث اليمني.
6. الاسهام في رقي الآداب والفنون وتقديم العلوم.
7. توفير المناخ الأكاديمي المساعد على حرية الفكر والتعبير والنشر بما لا يتعارض مع الإسلام وقيمه السامية ومثله العليا.
8. تقوية الروابط مع الجامعات والمؤسسات العامة والخاصة في البلاد بما يكفل التفاعل المتبادل والبناء للمعارف والخبرات والموارد والمشاركة التي تكفل الاسهام الفعال في إحداث التنمية الشاملة في البلاد.
9. توثيق الروابط العلمية والثقافية مع الجامعات والهيئات العلمية ومراكز البحوث والتطوير العربية والأجنبية بما يساعد على تطوير الجامعة وتعزيز مكانتها.
10. تقديم الدراسات والاستشارات الفنية والمتخصصة لمختلف أجهزة الدولة ومؤسساتها العامة والمختلطة.
11. المساهمة في تطوير السياسات وأساليب العمل في مؤسسات وأجهزة الدولة والقطاعين العام والخاص وتقديم النماذج والتجارب المبتكرة لحل المشاكل المختلفة.
12. -12رفع كفاءة العاملين في مؤسسات وأجهزة الدولة والقطاعين العام والخاص، وذلك من خلال المساهمة في برامج الإعداد والتأهيل أثناء الخدمة.

4. Faculty Vision, Mission and Goals:

4.1 Faculty Vision

الريادة أكاديمياً وبحثياً في مجالات الحوسبة والتكنولوجيا على المستوى الوطني والإقليمي.

4.2 Faculty Mission



تقديم برامج أكاديمية متميزة وتوفير بيئة تعليمية وبحثية محفزة في مجالات الحوسبة التكنولوجية وفقاً لمعايير الجودة و الاعتماد الأكاديمي وتعزيز الشراكة والمسئولية المجتمعية ومواكبة متطلبات سوق العمل.

4.3 Faculty Goals

1. تقديم وتطوير برامج أكاديمية وبحثية متميزة في مجالات الحاسوب وتكنولوجيا المعلومات وفقاً لمتطلبات الجودة والاعتماد الأكاديمي.
2. إعداد كوادر علمية وبحثية متخصصة في مجالات الحاسوب وتكنولوجيا المعلومات قادرة على المنافسة والإبداع في سوق العمل محلياً وإقليمياً.
3. المساهمة في تطوير المعرفة في مجالات الحاسوب وتكنولوجيا المعلومات من خلال تشجيع البحث العلمي وتوجيهه لخدمة المجتمع وتنميته .
4. تقديم الاستشارات العلمية والتقنية ذات العلاقة بمجالات الحاسوب وتكنولوجيا المعلومات والمساهمة في تدريب الكوادر الفنية للقطاعات المختلفة .
5. إقامة علاقات شراكة مع المؤسسات العلمية المناظرة لتبادل الخبرات في المجالات العلمية والبحثية.

5. Department Vision, Mission and Goals:

5.1 Department Vision

أن يكون رائداً في مجالات علوم الحاسوب أكاديمياً وبحثياً على المستوى المحلي والإقليمي..

5.2 Department Mission

تقديم تعليم ذو جودة عالية وبيئة مناسبة وتزويد الطلاب بالمعارف والمهارات اللازمة والتدريب بما يمكنهم من تحديد واستعمال وتقييم المعرفة والمعلومات والبحث العلمي والابتكار لخدمة المجتمع وتلبية متطلبات سوق العمل.

5.3 Department Goals

1. تقديم برامج أكاديمية في مجالات علوم الحاسوب وفقاً لمعايير الجودة والاعتماد الأكاديمي المحلية والدولية .
2. توفير بيئة أكاديمية ملائمة وتشجيع البحث العلمي والدراسات العليا واستقطاب الكوادر المتميزة من أعضاء هيئة التدريس وتأهيلهم أكاديمياً ، بحثياً ومهنياً.
3. رفد سوق العمل المحلي والإقليمي بكوادر كفؤة ومؤهلة قادرة على بناء نظم حاسوبية لحل المشكلات بعد تحليلها والاختيار الأمثل للأطر النظرية والأدوات والتقنيات المطلوبة لعملية التنفيذ.
4. تعزيز الشراكة مع القطاعات المختلفة وتقديم الاستشارات والخدمات العلمية والتقنية والتطبيقية ذات العلاقة بمجالات علوم الحاسوب والمساهمة في تدريب الكوادر الفنية وبما يلبي متطلبات سوق العمل.



6. Program Mission, Goals, and Outcomes

6.1 Program Mission

تقديم تعليم ذو جودة عالية وبيئة مناسبة وتزويد الطلاب بالمعارف والمهارات اللازمة والتدريب بما يمكنهم من تحديد واستعمال وتقييم المعرفة والمعلومات والبحث العلمي والابتكار لخدمة المجتمع وتلبية متطلبات سوق العمل

Qualifying cadres in the analysis and design of information systems and methods of managing through educational and research environment characterized by updated study plans and efficient teaching staff that contribute to the development of the work of institutions and meet the requirements of the labor market

6.2 The overall aims of the program

1.	Providing students with necessary theoretical knowledge and practical skills in computer Science field.	1. تزويد الطلبة بالمعارف النظرية والمهارات التطبيقية اللازمة في مجال علوم الحاسوب
2.	Providing students with communication skills, continuous learning and teamwork to produce work that includes identifying the problem and building computer solutions in the professional, legal and ethical framework.	2. تزويد الطلبة بمهارات الاتصال والتعلم المستمر والعمل الجماعي لإنتاج عمل يتضمن تحديد المشكلة وبناء حلول حاسوبية في الإطار المهني والقانوني والأخلاقي.
3.	Developing students' creative skills to develop and evaluate computer systems, improve and ensure their quality.	3. تنمية المهارات الإبداعية لدى الطلبة لتطوير ولتقييم الأنظمة الحاسوبية وتحسينها وضمان جودتها.
4.	Qualifying graduates to join graduate programs in Yemeni and international universities.	4. تأهيل الخريجين للالتحاق ببرامج الدراسات العليا في الجامعات اليمنية والعالمية.
5.	The adoption of an appropriate and modern technologies to the needs of the community.	5. تبني التقنيات الحديثة والمناسبة لحاجات المجتمع.

7. Program Standards& Benchmarks:

7.1 Academic Standards

1. National Academic Reference Standards (NARS) for Undergraduate Computing Programs, Council for Accreditation & Quality Assurance, Republic of Yemen, May 2018 (First Edition).
2. 1st Level standard of Academic Program Specification (2017), Council for Accreditation & Quality Assurance, Yemen
3. Curriculum Guidelines for Undergraduate Degree Programs in Computer Science, CS 2013, Association for Computing Machinery (ACM).
4. ABET, Criteria For Accrediting Engineering Technology Programs, 2016 – 2017 (Refer to Annex -1)

7.2 Program Benchmarks:

ABET Accredited CS Programs

1. Bachelor of Computer Science, Department of Computer Science AMA University, Philippines
2. Bachelor of Computer Science, Department of Computer Science, American University in the Emirates, United Arab Emirates.



3. Bachelor of Computer Science, Department of Computer Science, American University of Kuwait, Kuwait.
4. Bachelor of Computer Science, Department of Computer Science, Arab Academy for Science and Technology and Maritime Transport (Egypt)
5. Bachelor of Computer Science, Department of Computer Science, California Baptist University, United States.
6. Bachelor of Computer Science, Department of Computer Science, King Saud University, Saudi Arabia
7. Refer to Annex (2): Survey of names Similar Accredited Programs at International Universities (Benchmarks), All ABET Accredited CS Programs
8. Refer to annex5 - Annex-5, Survey of Course Names of Similar Program

8. Graduates Attributes

Upon successful completion of an undergraduate computer science program, the graduates will be able to:

1. Demonstrate an understanding of organization theory, mathematical foundations and business needs.
إظهار الفهم للنظريات والأسس الرياضية واحتياجات سوق العمل
2. Understand computer science concepts to start further long-life learning.
فهم أساسيات علوم الحاسوب التي تمكنه من الاستمرار في عملة التعلم
3. Apply computer science theory, mathematics, algorithms and models for analyzing, designing, implementing and evaluating computer-based systems.
تطبيق المفاهيم النظرية لعلوم الحاسوب والرياضيات والخوارزميات لتحليل وتصميم وتنفيذ وتقييم الأنظمة الحاسوبية
4. Identify and apply relevant problem-solving and decision-making methodologies.
تحديد وتطبيق مفاهيم حل المشكلات الحاسوبية وطرق اتخاذ القرار
5. Apply acquired knowledge to plan and track progress during software development and assess their qualities.
تطبيق المعرفة اللازمة للتخطيط والمتابعة والتقييم لعملية سير عملية تطوير البرمجيات وجودتها.
6. Possess a solid foundation that allows and encourages them to maintain their skills as the field evolves.
بناء قدرات علمية صلبة تمكن الطالب من اكتساب المهارات بحسب المتغيرات السريعة في مجال علوم الحاسوب
7. Demonstrate the ability to evaluate the current software applications on the bases of cost effectiveness and organization requirements.
القدرة على تقييم البرمجيات والتطبيقات على أسس الكفاءة والكلفة ومتطلبات المؤسسات



8. Display commitment to ethical, legal, security and social responsibilities as computer science professionals.

الالتزام بالمسؤولية الأخلاقية والمهنية والمجتمعية في مجال علوم الحاسوب

9. Demonstrate research capability, communication skills and enhance employability

إظهار القدرة على إجراء البحوث العلمية والتواصل الفعال

9. Learning Outcomes

A. Knowledge and Understanding:

Upon successful completion of the Program, graduates should be able to:

- A1. Demonstrate knowledge of mathematical foundations, algorithms and computer science theory in modelling and designing computer-based systems.
- A2. Identify a wide range of software and hardware components, techniques, tools and various controlling mechanisms used in computer systems.
- A3. Describe the principles of various programming skills, data structures, computer organization and architecture, intelligent systems, parallel processing, distributed computing, and software development process and models.
- A4. Explain the fundamentals of computer networks, security, Professional ethic, database systems, operating systems, computer-human interaction, logic, machine learning and image processing.
- A5. Describe basic concepts of web applications development, mobile and multimedia applications, computer graphics, computational and compiler theory, systems programming and programming language design.
- A6. Identify users and business needs relevant to computer-based systems, software applications and projects.

B. Cognitive/ Intellectual Skills:

Upon successful completion of the program, graduates should be able to:

- B1 Formulate and analyze problems according to analytical and mathematical models, and plan proper strategies for solutions.
- B2 Explore and compare appropriate tools, techniques or models for analyzing computer systems and computer application problems.
- B3 Design and develop appropriate software architecture, and software tools and components based on specific application.



- B4 Analyze secured computer-based system components or software applications including web, mobile and multimedia applications to meet the criteria defined for its current use and future development.
- B5 Investigate and evaluate the current system based on software components in terms of their reliability factors, risk management and safety within a given environment, and propose a variety of secured and integrated solutions based on standard measurements.
- B6 Explore the impacts of computer science on individuals, organizations and society.

B. Practical and Professional Skills:

Upon successful completion of the program, graduates should be able to:

- C1. Employ mathematical foundations, algorithms, Communication and programming skills, current techniques and tools in detailed design of computer-based systems and its implementation to meet desired needs.
- C2. Apply appropriate theoretical knowledge, tools and techniques to specify, implement, and debug of program components.
- C3. Implement an appropriate software architecture and software components interface based on applications specification design.
- C4. Operate effectively on programming languages, system programs, software tools and frameworks, web applications development, mobile and multimedia applications, distributed systems and other computer applications.
- C5. Select available software such as APIs or open source code for constructing a rapid web application and other software applications.
- C6. Build different secure software applications using different programming languages environments on different platforms along with suitable evaluation.

D. General and Transferable Skills:

Upon successful completion of the program, graduates should be able to:

- D1. Work effectively individually or within a team to accomplish a common goal.
- D2. Write a technical report and make an effective presentation for different audiences in different environments.
- D3. Engage in research and long-life learning.
- D4. Communicate effectively with specialists as well as non-specialists to solve computer science problems.



D5. Demonstrate commitment to ethical, legal, security, and social aspects and responsibilities related to the field of computer science.

10. Teaching and Learning Strategies

1. Active lectures
2. Tutorials
3. Seminar/ project/presentation
4. Interactive class discussions
5. Exercises and home works
6. Laboratory based session
7. Directed self-study/Independent learning
8. Problem solving
9. Team work (group learning)

11. Assessment Tools

1. Written tests
2. Exams
3. Written assignments
4. Oral exams
5. Project Report
6. Coursework Activities
7. Home works and assignments
8. Case studies
9. Presentations
10. Discussion

11.1 Project Assessment

Each project will be assessed by a committee of three members as follows

Item	Marks Distribution
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Presentations	10%
Project Report	10%
Discussion	10%
Total	30%

11.2 Training Course Assessment:

- Report
- Presentations
- Discussion

11.3 Alignment of Program Intended Learning Outcomes (PILOs) with Teaching Strategies and Assessment Methods:

PILOs	Teaching Strategy	Assessment Methods
Knowledge and Understanding	Active lectures, Seminars/ projects	Written tests, Exams, Written assignments
Intellectual Skills	Interactive class, discussions, Exercises and home works, Problem solving	Coursework Activities, Case studies, Discussion
Professional & practical skills	Tutorials, Exercises and home works, Laboratory based session	Report, Presentations, Assignments, projects
General & Transferable Skills	Seminar, project, presentation, group learning	Presentations, Project Report

12. Intended Learning Outcomes Mapping:

See Annexes 6,7, and 8.

(Annex 6: Alignment of Program Themes with Program Intended Learning Outcomes (PILOs))

(Annex 7: Coding System and Alignment of Courses with Program Intended Learning Outcomes (PILOs))

(Annex 8: Matrix of Mapping Program PILO's With Courses)

13. Program Structure

13.1 Requirements

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No	Requirements		No. of Courses	Credit Hours	Rational Weight %
1	University Requirements	Compulsory	8	17	12.8%
		Elective	-	-	
2	Faculty Requirements	Compulsory	6	15	11.2%
		Elective	-	-	
4	Program Requirements	Compulsory	32	96	72%
		Elective	2	6	4%
45	Field training, and the rate of the total hours of the program	--			
Total:			48	134	100%

13.2 University Requirements

Compulsory Courses (13 hrs)								
No	Course Code	Course Name	L	T	P	Cr. Hrs.	Prerequisites, Co-requisites	Level/ Semester
1		Islamic Culture	2	-	-	2		L1,S1
2		Arabic Language (1)	2	-	-	2		L1,S1
3		English Language (1)	2	-	-	2		L1,S1
4		Arabic Language (2)	2	-	-	2	Arabic Language (1)	L1,S2
5		English Language (2)	2	-	-	2	English Language (1)	L1,S2
6		Arabic Israeli Conflict	2	-	-	2		L1,S1
7		National Culture	2	-	-	2		L1,S2
8		Computer Skills	2	-	2	3		L1,S1
Total Credit						17		

13.3 Faculty Requirements

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No	Course Code	Course Name	L	T	P	Cr. Hrs.	Prerequisites, Co-requisites	Level/ Semester
1		Programming Fundamentals	2	-	2	3		1/1
2		Communication Skills	2	-	-	2	English Language (1)	2/2
3		Professional Ethics	2	-	-	2		4/1
4		Research Methodology	2	-	-	2		3/1
5		Graduation Project (1)	3	-	-	3		4/1
6		Graduation Project (2)	3	-	-	3		4/2
Total Credit						15		

13.4 Program Major

Compulsory Courses (99 hrs)								
No	Course Code	Course Name	L	T	P	Cr. Hrs.	Prerequisites, Co-requisites	Level/ Semester
1		Mathematics (1).	2	2	-	3		
2		Mathematics (2).	2	2	-	3		
3		Discrete Mathematics	2	2	-	-		
4		Introduction to Computer Science	3	-	-	3		
5		Computer Programming	2	-	2	3		
6		Object-Oriented Programming	2	-	2	3		
7		Web Design	2	-	2	3		
8		Computer Networks	2	-	2	3		
9		Probability and Statistics	2	2	-	3		
10		Digital Logic Design.	2	-	2	3		
11		Database Fundamentals	2	-	2	3		
12		Operating Systems	2	-	2	3		
13		Data Structures and Algorithms	2	-	2	3		

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14		Web Development	2	-	2	3		
15		Database Management Systems	2	-	2	3		
16		Linear Algebra	2	2	-	3		
17		Computer Architecture and Organization	2	-	2	3		
18		Artificial Intelligence	2	-	2	3		
19		Information Security	2		2	3		
20		Software Engineering	3	-	-	3		
21		Human Computer Interaction	2	-	2	3		
22		Mobile Application Development	2	-	2	3		
23		Compilers Design	2	-	2	3		
24		Project Management	2	-	2	3		
25		Computer Graphics and Visualization	2	-	2	3		
26		Modeling and Simulation	2	-	2	3		
27		Algorithms and analysis	2	-	2	3		
28		Advanced Programming	2	-	2	3		
29		Image Processing and Computer Vision	2	-	2	3		
30		Programming languages Techniques (Arduino)	2	-	2	3		
31		Blockchain	2	-	2	3		
32		Cloud Computing and IoT	2	-	2	3		
Total			96					

13.5 Program Elective Courses: 6 hours

Elective Course								
No	Course Code	Course Name	L	T	P	Cr. Hrs.	Prerequisites, Co-requisites	Level/ Semester
1		Cryptography and Data Security				3		
2		Games Development				3		
3		Network Programming				3		
4		Machine learning				3		

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5		Data Mining and Data warehousing				3		
6		Big data and analytics				3		
7		Cryptocurrency				3		
8		Data Science				3		

14. Study Plan

Bachelor of Computer Science Program Study Plan

Code	Course Name	أسماء المقرر	L/S	CHs	L	P	T	Prerequisites
SUI100	Islamic Culture	الثقافة الإسلامية	1/1	2	2	-	-	
SUA101	Arabic Language (101)	اللغة العربية (101)	1/1	2	2	-	-	
SUE101	English Language (101)	اللغة الانجليزية (101)	1/1	2	2	-	-	
SUCONF	Arabic Israeli Conflict	الصراع العربي الإسرائيلي	1/1	2	2	-	-	
CCS100	Computer Skills	مهارات الحاسوب	1/1	3	2	2	-	
CCS111	Programming Fundamentals	أساسيات البرمجة	1/1	3	2	2	-	
MAT101	Mathematics (1)	الرياضيات (1)	1/1	3	2	-	2	
	CHs Total of the Semester	إجمالي الساعات المعتمدة في الفصل الدراسي		17	14	4	2	
SUA102	Arabic Language (102)	اللغة العربية (102)	1/2	2	2	-	-	SUA101
SUE102	English Language (102)	اللغة الانجليزية (102)	1/2	2	2	-	-	SUE101
SUNC	National Culture	الثقافة الوطنية	1/2	2	2	-	-	
MAT102	Mathematics (2)	الرياضيات (2)	1/2	3	2	-	2	MAT101
	Discrete Mathematics	الرياضيات المتقطعة	1/2	3	2	-	2	
	Computer Programming	برمجة الحاسوب	1/2	3	2	2	-	
	Introduction to Computer Science	مقدمة في علوم الحاسوب	1/2	3	2	2	-	
	CHs Total of the Semester	إجمالي الساعات المعتمدة في الفصل الدراسي		18	14	4	4	
	Object-Oriented Programming	البرمجة الكائنية الموجهة	2/1	3	2	2	-	
	Web Design	تصميم الويب	2/1	3	2	2	-	
	Computer Networks	شبكات الحاسوب	2/1	3	2	2	-	
	Probability and Statistics	الإحصاء والاحتمالات	2/1	3	2	-	2	
	Database Fundamentals	أساسيات قواعد البيانات	2/1	3	2	2	-	
	Digital Logic Design	التصميم المنطقي الرقمي	2/1	3	2	2	-	



	CHs Total of the Semester	إجمالي الساعات المعتمدة في الفصل الدراسي		18	12	10	2	
FRCS202	Communication Skills	مهارات الاتصال	2/2	2	2	-	-	
	Operating Systems	نظم التشغيل	2/2	3	2	2	-	
	Data Structures and Algorithms	هياكل البيانات والخوارزميات	2/2	3	2	2	-	
	Web Development	تطوير الويب	2/2	3	2	2	-	
	Database Management Systems	نظم إدارة قواعد البيانات	2/2	3	2	2	-	
	Computer Organization and Architecture	معمارية وتنظيم الحاسوب	2/2	3	2	2	-	
	Linear Algebra	الجبر الخطي	2/2	3	2	-	2	
	CHs Total of the Semester	إجمالي الساعات المعتمدة في الفصل الدراسي		20	14	10	2	
FCRM301	Research Methodology	منهجية البحث	3/1	2	2	-	-	
	Information Security	أمن المعلومات	3/1	3	2	2	-	
	Human-Computer Interaction	تفاعل الإنسان والحاسوب	3/1	3	2	2	-	
	Software Engineering	هندسة البرمجيات	3/1	3	2	2	-	
	Artificial Intelligence	الذكاء الاصطناعي	3/1	3	2	2	-	
	Advanced Programming	البرمجة المتقدمة	3/1	3	2	2	-	
	Computational Theory	نظرية الحوسبة	3/1	3	2	2	-	
	CHs Total of the Semester	إجمالي الساعات المعتمدة في الفصل الدراسي		20	14	12	0	
	Professional Ethics	أخلاقيات المهنة	3/2	2	2	-	-	
	Project Management	إدارة المشاريع	3/2	3	2	2	-	
	Mobile Applications Development	تطوير تطبيقات الموبايل	3/2	3	2	2	-	
	Compilers Design	تصميم المترجمات	3/2	3	2	2	-	
	Computer Graphics and Visualization	الرسم بالحاسوب والتصور	3/2	3	2	2	-	
	Algorithms and Analysis	الخوارزميات والتحليل	3/2	3	2	2	-	
	Science Elective	اختياري علوم	3/2	2	2	-	-	
	CHs Total of the Semester	إجمالي الساعات المعتمدة في الفصل الدراسي		19	14	10	0	
	Modeling and Simulation	النمذجة والمحاكاة	4/1	3	2	2	-	
	Programming languages Techniques (Arduino)	تقنيات لغات البرمجة (أردوينو)	4/1	3	2	2	-	
	Elective (1)	اختياري (1)	4/1	3	-	-	-	
	Entrepreneurship	ريادة الأعمال	4/1	2	2	-	-	

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	Graduation Project (1)	مشروع التخرج (1)	4/1	3	1	-	4	
	CHs Total of the Semester	إجمالي الساعات المعتمدة في الفصل الدراسي		14	7	4	4	
	Blockchain	سلسلة الكتل	4/2	3	2	2	-	
	Cloud Computing and IoT	الحوسبة السحابية وإنترنت الأشياء	4/2	3	2	2	-	
	Elective (2)	اختياري (2)	4/2	3	-	-	-	
	Graduation Project (2)	مشروع التخرج (2)	4/2	3	1	-	4	
	CHs Total of the Semester			12	5	4	4	
	CHs Total of the Program	إجمالي الساعات المعتمدة في البرنامج		138	94	58	18	

Elective Courses

Code	Course Name		L/S	CHs	L	P	T	
	Cryptography and Data Security	التشفير وأمن البيانات	elec	3	2	2	-	
	Games Development	تطوير الألعاب	elec	3	2	2	-	
	Network Programming	برمجة الشبكات	elec	3	2	2	-	
	Machine learning	تعلم الآلة	elec	3	2	2	-	
	Data Mining and Data warehousing	تنقيب البيانات ومستودعاتها	elec	3	2	2	-	
	Big data and analytics	البيانات الضخمة والتحليلات	elec	3	2	2	-	
	Image Processing and Computer Vision	الرؤية الحاسوبية ومعالجة الصور	elec	3	2	2	-	
	Data Science	علم البيانات	elec	3	2	2	-	
	Science Elective Courses:	مقررات العلوم الاختيارية:						
	General Physic	فيزياء عامة	elec	2	2	-	-	
	General Biology	أحياء عامة	elec	2	2	-	-	
	General Chemistry	كيمياء عامة	elec	2	2	-	-	

15. Distribution of Total Credit Hours

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Level	Term	University Requirements		Faculty Requirements		Program Requirements		Program Electives		Training		Total Cr. Hrs		Total Cr. Hrs./ Level
		No. of Courses	Credit Hours	No. of Courses	Credit Hours	No. of Courses	Credit Hours	No. of Courses	Credit Hours	No. of Courses	Credit Hours	No. of Courses	Credit Hours	
First	First	5	11	1	3	1	3	0	0	0	0	7	17	35
	Second	3	6	0	0	4	12	0	0	0	0	7	18	
Second	First	0	0	0	0	6	18	0	0	0	0	6	18	38
	Second	0	0	1	2	6	18	0	0	0	0	7	20	
Third	First	0	0	2	4	4	12	0	0	0	0	6	16	34
	Second	0	0	0	0	6	18	0	0	0	0	6	18	
Fourth	First	0	0	1	3	3	9	1	3	0	0	5	15	27
	Second	0	0	1	3	2	6	1	3	0	0	4	12	
Total		8	17	6	15	32	96	2	6	0	0	48	134	134
Percentage:		12.8%		11.2%		72%		4%		0%				

13 Admission Requirements:

- Admissions to the program shall be made as per the admission rules set by the Ministry of Higher Education and Scientific Research as well as University admission guidelines.
- General Secondary school certificate (Science Section) or any equivalent certificate with grade as specified in the admission rules made by Ministry of Higher Education and Scientific Research.
- Pass the aptitude test and personal interview.
- Any necessary requirement for specialization, decided by the Scientific Section.

14 Attendance and Graduation Requirements:

- Student attendance should not be less than
- Student will graduate after successfully passing all program requirements.
- Total credit hours for the program is credit hours.
- Minimum score for any student to pass any credit hours' course is degree.

15 Grading System:

From 90% to 100% of total marks	Excellent
From 80% to less than 89%	Very Good
From 65% to less than 79%	Good
From 50% to less than 64%	Pass
Less than 50%	Poor/Fail

16 Facilities Required for Running the Program

- Lecture Rooms with facilities such as chairs and tables, data show, Smart Board, etc.
- Lab with facilities such as chairs and tables, laboratory equipment, hardware and software, data show, Smart Board, etc.

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3. Library and study room.

4. Internet

17 Learning Resources:

Learning Resources	Required Material
References and Textbooks	Books (softcopy, Hardcopy)
Scientific Journals	-
Computers and Electronic Devices	Computer Labs & simulation Tools
Computer software	Applications, Programming Languages, DBMS
Library needs	Hardcopy Books, Digital Library
Other Resources	

18 Program evaluation and improvement

Stakeholders participated	Assessment method	Sample size
Final year students	Focus group discussions	20%
Graduates	Graduation project	20%
Academic Staff	Interviews	100%
Employment agencies (views)	Questionnaires	50%
External Examiners	Interviews	100%
Others CAQA	Interviews/ Documents analysis	100%

19 Program Policies

Based on University Regulations

1. (Class Attendance):

A student should attend not less than 75 % of total hours of the subject; otherwise he/she will not be able to take the exam and will be considered as exam failure. If the student is absent due to illness, he/she should bring a proof statement from university Clinic. If the absent is more than 25% of a course total contact hour, student will be required to retake the entire course again.

2. (Tardy) :

For late in attending the class, the student will be initially notified. If he repeated lateness in attending class, he/she will be considered as absent.

3. (Exam Attendance/Punctuality) :

A student should attend the exam on time. He/she is permitted to attend an exam half one hour from exam beginning, after that he/she will not be permitted to take the exam and he/she will be considered as absent in exam.



4. (Assignments & Projects) :

In general one assignment is given to the students after each chapter; the student has to submit all the assignments for checking on time, mostly one week after given the assignment.

5. (Cheating) :

For cheating in exam, a student will be considered as fail. In case the cheating is repeated three times during his/her study the student will be disengaged from the Faculty.

6. (Plagiarism) :

Plagiarism is the attending of a student the exam of a course instead of another student. If the examination committee proofed a plagiarism of a student, he/she will be disengaged from the Faculty. The final disengagement of the student from the Faculty should be confirmed from the Student Council Affair of the university or according to the university roles.

7. (Other policies) :

- Mobile phones are not allowed to use during a class lecture. It must be closed; otherwise the student will be asked to leave the lecture room.
- Mobile phones are not allowed in class during the examination.
- Lecture notes and assignments might be given directly to students using soft or hard copy.

Team Work

No.	Full Name	Signature
1		
2		
3		
4		
5	Asst. Prof. Dr. Mossa Mosleh Ahmed Ghurab.	
6	Prof. Dr. Malek Nasser Ali Algabri.	
7		

Attached Appendices

No.	Appendix No.	Description
1	(Annex-1)	Academic Standards Curriculum Criteria of Accreditation Board
2	Annex (2)	Survey of names Similar Accredited Programs at International Universities (Benchmarks)
3	Annex-5	Survey of Course Names of Similar Program
4	Annex-6	Alignment of Program Objectives with Program Intended Learning Outcomes
5	Annex-7	Alignment of Program Objectives with Council of Accreditation Standards

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6	Annex-8	Themes and their Weightage with Program Intended Learning Outcomes (PILOs)
7	Annex-9	Coding System and Alignment of Courses with Program Intended Learning Outcomes (PILOs)
8	Annex (10)	Matrix of mapping program (P ILO's) with courses

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The following annexes are prepared to complete the Computer Science Program Specification in a format consistent with the Artificial Intelligence program annexes and aligned with the approved study plan.

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Reference / Standard	Scope	Key criteria relevant to the CS curriculum (summary)
National Academic Reference Standards (NARS) – 2018 (Yemen)	National reference standards	Defines expected learning outcomes domains (Knowledge, Intellectual, Practical/Professional, Transferable) and program quality requirements.
CAQA-Yemen – Academic Program Specification Level Standard (2017)	Program specification template and QA requirements	Program documentation structure, intended learning outcomes, assessment methods, resources, and continuous improvement processes.
ACM/IEEE Computer Science Curricula (CS2013) and updates	International curricular guidance	Knowledge areas coverage, core/elective topics, curriculum balance between theory, practice, and professional skills.
ABET Computing Accreditation Commission – Program criteria (Computing/CS)	International accreditation reference	Student outcomes, curriculum breadth and depth, continuous improvement, faculty/resources, and professional practice considerations.



University	Country	Program (Example)	Accreditation / Notes (if applicable)
AMA University	Bahrain	BSc Computer Science	Accredited national/institutional QA
American University in the Emirates	UAE	BSc Computer Science	Accredited institutional QA
American University of Kuwait	Kuwait	BSc Computer Science	Accredited institutional QA
Arab Academy for Science, Technology & Maritime Transport	Egypt	BSc Computer Science	Accredited institutional QA
California Baptist University	USA	BS Computer Science	Regional accreditation; CS program reference
King Saud University	Saudi Arabia	BSc Computer Science	National accreditation reference
Jordan University of Science and Technology	Jordan	BSc Computer Science	Accredited national QA reference
University of Wollongong	Australia	Computer Science programs	International benchmark reference
University of Malaya	Malaysia	BSc Computer Science	International benchmark reference
University of Manchester	UK	BSc Computer Science	International benchmark reference

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Theme / Knowledge Area	Common course titles in similar CS programs	Equivalent courses in this CS program
Programming & Algorithms	Programming Fundamentals, Programming I/II, OOP, Advanced Programming, Data Structures, Algorithms	Programming Fundamentals; Computer Programming; Object-Oriented Programming; Data Structures and Algorithms; Advanced Programming; Algorithms and Analysis; Programming languages Techniques (Arduino)
General Education & Skills	General Education, Communication, Professional Ethics, Entrepreneurship	Islamic Culture; Arabic Language (101); English Language (101); Arabic Israeli Conflict; Arabic Language (102); English Language (102); National Culture; Communication Skills; Professional Ethics; Entrepreneurship
Mathematics & Statistics	Calculus/Mathematics, Discrete Mathematics, Linear Algebra, Probability & Statistics	Mathematics (1); Mathematics (2); Discrete Mathematics; Probability and Statistics; Linear Algebra
Research & Project	Research Methodology, Project Management, Capstone/Graduation Projects	Research Methodology; Project Management; Graduation Project (1); Graduation Project (2)
Program Courses		Computer Skills; Introduction to Computer Science; Software Engineering
Computer Systems	Digital Logic, Computer Organization/Architecture, Operating Systems	Digital Logic Design; Operating Systems; Computer Organization and Architecture
Data & Databases	Database Fundamentals, Database Management Systems	Database Fundamentals; Database Management Systems
Program Electives	Program Electives	Elective (1); Elective (2)
Emerging Technologies	Cloud Computing/IoT, Blockchain	Blockchain; Cloud Computing and IoT
Theory & Compilers	Theory of Computation, Compiler Design	Computational Theory; Compilers Design
Web Technologies	Web Design, Web Development	Web Design; Web Development
AI & Data	Artificial Intelligence, Machine Learning, Data Science	Artificial Intelligence
Graphics & Vision	Computer Graphics, Image Processing/Computer Vision	Computer Graphics and Visualization
Human-Computer Interaction		Human-Computer Interaction
Mobile Computing	Mobile Application Development	Mobile Applications Development
Networks	Computer Networks	Computer Networks
Security	Information Security, Cryptography	Information Security
Modeling & Simulation	Modeling and Simulation	Modeling and Simulation
Science Electives	Science Electives	Science Elective



Program PILOs vs. Program Objectives					
Program PILOs	PObj1	PObj2	PObj3	PObj4	PObj5
A1	√	√			
A2	√			√	√
B1	√	√		√	√
B2		√	√		√
C1	√	√	√		
C2	√		√		√
D1		√	√		
D2		√		√	√

Legend: √ = aligned.

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Accreditation standard domain	Description	PObj1	PObj2	PObj3	PObj4	PObj5
Std-A	Knowledge & Understanding	√			√	√
Std-B	Intellectual / Cognitive Skills		√	√		
Std-C	Practical / Professional Skills	√		√		√
Std-D	General / Transferable Skills		√		√	√

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Theme	Theme Code	#Courses	Credit Hours	Weight (%)	Main PILOs Covered
Programming & Algorithms	PROG	7	21	15.2%	A1, A2, B1, C1, D1
General Education & Skills	GE	10	20	14.5%	A1, D1, D2
Mathematics & Statistics	MATH	5	15	10.9%	A1, A2, B1
Research & Project	PRJ	4	11	8.0%	B2, C2, D1, D2
Program Courses	PC	3	9	6.5%	A1, A2, B1, B2, C1, C2, D1, D2
Computer Systems	SYS	3	9	6.5%	A1, A2, B1, B2, C1, C2
Data & Databases	DB	2	6	4.3%	A1, A2, B1, B2, C1, C2
Program Electives	EL	2	6	4.3%	A1, A2, B2, C2, D1, D2
Emerging Technologies	EM	2	6	4.3%	A1, A2, B2, C2, D2
Theory & Compilers	TH	2	6	4.3%	A1, A2, B1, B2
Web Technologies	WEB	2	6	4.3%	A1, B2, C1, C2, D1
AI & Data	AI	1	3	2.2%	A1, A2, B1, B2, C2, D2
Graphics & Vision	GV	1	3	2.2%	A1, A2, B2, C2
Human-Computer Interaction	HCI	1	3	2.2%	A1, B2, D1
Mobile Computing	MOB	1	3	2.2%	A1, B2, C1, C2, D1
Networks	NET	1	3	2.2%	A1, A2, B1, B2, C2
Security	SEC	1	3	2.2%	A1, A2, B1, B2, C2, D2
Modeling & Simulation	SIM	1	3	2.2%	A1, B2, C2
Science Electives	SCI	1	2	1.4%	A1, A2

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A unified coding system is applied for courses lacking codes in the study plan to support consistent mapping and reporting.

Theme	Theme Code	No.	Course Title	Course Code	CHs	Prerequisites/Co-requisites	PILOs
General Education & Skills	GE	1	Islamic Culture	SUI100	2		A1, D1, D2
General Education & Skills	GE	2	Arabic Language (101)	SUA101	2		A1, D1, D2
General Education & Skills	GE	3	English Language (101)	SUE101	2		A1, D1, D2
General Education & Skills	GE	4	Arabic Israeli Conflict	SUCONF	2		A1, D1, D2
Program Courses	PC	5	Computer Skills	CCS100	3		A1, A2, B1, B2, C1, C2, D1, D2
Programming & Algorithms	PROG	6	Programming Fundamentals	CCS111	3		A1, A2, B1, C1, D1
Mathematics & Statistics	MATH	7	Mathematics (1)	MAT101	3		A1, A2, B1
General Education & Skills	GE	8	Arabic Language (102)	SUA102	2	SUA101	A1, D1, D2
General Education & Skills	GE	9	English Language (102)	SUE102	2	SUE101	A1, D1, D2
General Education & Skills	GE	10	National Culture	SUNC	2		A1, D1, D2

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Rector of Sana'a University

Prof. Al-Qassim Mohammed Abbas



Mathematics & Statistics	MATH	11	Mathematics (2)	MAT102	3	MAT101	A1, A2, B1
Mathematics & Statistics	MATH	12	Discrete Mathematics	MAT103	3		A1, A2, B1
Programming & Algorithms	PROG	13	Computer Programming	CCS112	3		A1, A2, B1, C1, D1
Program Courses	PC	14	Introduction to Computer Science	CCS113	3		A1, A2, B1, B2, C1, C2, D1, D2
Programming & Algorithms	PROG	15	Object-Oriented Programming	CCS201	3		A1, A2, B1, C1, D1
Web Technologies	WEB	16	Web Design	CCS202	3		A1, B2, C1, C2, D1
Networks	NET	17	Computer Networks	CCS203	3		A1, A2, B1, B2, C2
Mathematics & Statistics	MATH	18	Probability and Statistics	MAT201	3		A1, A2, B1
Data & Databases	DB	19	Database Fundamentals	CCS204	3		A1, A2, B1, B2, C1, C2
Computer Systems	SYS	20	Digital Logic Design	CCS205	3		A1, A2, B1, B2, C1, C2
General Education & Skills	GE	21	Communication Skills	FRCS202	2		A1, D1, D2
Computer Systems	SYS	22	Operating Systems	CCS211	3		A1, A2, B1, B2, C1, C2
Programming & Algorithms	PROG	23	Data Structures and Algorithms	CCS212	3		A1, A2, B1, C1, D1
Web Technologies	WEB	24	Web Development	CCS213	3		A1, B2, C1, C2, D1
Data & Databases	DB	25	Database Management Systems	CCS214	3		A1, A2, B1, B2, C1, C2
Computer Systems	SYS	26	Computer Organization and Architecture	CCS215	3		A1, A2, B1, B2, C1, C2

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Mathematics & Statistics	MATH	27	Linear Algebra	MAT202	3	A1, A2, B1
Research & Project	PRJ	28	Research Methodology	FCRM301	2	B2, C2, D1, D2
Security	SEC	29	Information Security	CCS301	3	A1, A2, B1, B2, C2, D2
Human-Computer Interaction	HCI	30	Human-Computer Interaction	CCS302	3	A1, B2, D1
Program Courses	PC	31	Software Engineering	CCS303	3	A1, A2, B1, B2, C1, C2, D1, D2
AI & Data	AI	32	Artificial Intelligence	CCS304	3	A1, A2, B1, B2, C2, D2
Programming & Algorithms	PROG	33	Advanced Programming	CCS305	3	A1, A2, B1, C1, D1
Theory & Compilers	TH	34	Computational Theory	CCS306	3	A1, A2, B1, B2
General Education & Skills	GE	35	Professional Ethics	FRCS301	2	A1, D1, D2
Research & Project	PRJ	36	Project Management	CCS307	3	B2, C2, D1, D2
Mobile Computing	MOB	37	Mobile Applications Development	CCS308	3	A1, B2, C1, C2, D1
Theory & Compilers	TH	38	Compilers Design	CCS309	3	A1, A2, B1, B2
Graphics & Vision	GV	39	Computer Graphics and Visualization	CCS310	3	A1, A2, B2, C2
Programming & Algorithms	PROG	40	Algorithms and Analysis	CCS311	3	A1, A2, B1, C1, D1
Science Electives	SCI	41	Science Elective	SCI-ELEC	2	A1, A2
Modeling & Simulation	SIM	42	Modeling and Simulation	CCS401	3	A1, B2, C2

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Programming & Algorithms	PROG	43	Programming languages Techniques (Arduino)	CCS402	3	A1, A2, B1, C1, D1
Program Electives	EL	44	Elective (1)	CS-ELEC1	3	A1, A2, B2, C2, D1, D2
General Education & Skills	GE	45	Entrepreneurship	ENT401	2	A1, D1, D2
Research & Project	PRJ	46	Graduation Project (1)	GP401	3	B2, C2, D1, D2
Emerging Technologies	EM	47	Blockchain	CCS403	3	A1, A2, B2, C2, D2
Emerging Technologies	EM	48	Cloud Computing and IoT	CCS404	3	A1, A2, B2, C2, D2
Program Electives	EL	49	Elective (2)	CS-ELEC2	3	A1, A2, B2, C2, D1, D2
Research & Project	PRJ	50	Graduation Project (2)	GP402	3	B2, C2, D1, D2

Elective options (for Elective 1 / Elective 2 and Science Elective):

Theme	Theme Code	No.	Course Title	Course Code	CHs	Prerequisites/Co-requisites	PILOs
Security	SEC	1	Cryptography and Data Security	CSE401	3		A1, A2, B1, B2, C2, D2
Program Courses	PC	2	Games Development	CSE402	3		A1, A2, B1, B2, C1, C2, D1, D2
Programming & Algorithms	PROG	3	Network Programming	CSE403	3		A1, A2, B1, C1, D1
AI & Data	AI	4	Machine learning	CSE404	3		A1, A2, B1, B2, C2, D2
Program Courses	PC	5	Data Mining and Data warehousing	CSE405	3		A1, A2, B1, B2, C1, C2, D1, D2

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AI & Data	AI	6	Big data and analytics	CSE406	3	A1, A2, B1, B2, C2, D2
Graphics & Vision	GV	7	Image Processing and Computer Vision	CSE407	3	A1, A2, B2, C2
AI & Data	AI	8	Data Science	CSE408	3	A1, A2, B1, B2, C2, D2
Science Electives	SCI	9	Science Elective Courses:	CSE-EL		A1, A2
Science Electives	SCI	10	General Physic	SCI201	2	A1, A2
Science Electives	SCI	11	General Biology	SCI202	2	A1, A2
Science Electives	SCI	12	General Chemistry	SCI203	2	A1, A2

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I = Introduced; P = Practiced; M/A = Mastered/Advanced

#	Course Code	Course Title	Program Intended Learning Outcomes (PILOs)							
			A1	A2	B1	B2	C1	C2	D1	D2
1	SUI100	Islamic Culture	I						I	I
2	SUA101	Arabic Language (101)	I						I	I
3	SUE101	English Language (101)	I						I	I
4	SUCONF	Arabic Israeli Conflict	I						I	I
5	CCS100	Computer Skills	I	I	I	I	I	I	I	I
6	CCS111	Programming Fundamentals	I	I	I		I		I	
7	MAT101	Mathematics (1)	I	I	I					
8	SUA102	Arabic Language (102)	I						I	I
9	SUE102	English Language (102)	I						I	I
10	SUNC	National Culture	I						I	I
11	MAT102	Mathematics (2)	I	I	I					
12	MAT103	Discrete Mathematics	I	I	I					
13	CCS112	Computer Programming	I	I	I		I		I	
14	CCS113	Introduction to Computer Science	I	I	I	I	I	I	I	I

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15	CCS201	Object-Oriented Programming	P	P	P		P		P	
16	CCS202	Web Design	P			P	P	P	P	
17	CCS203	Computer Networks	P	P	P	P		P		
18	MAT201	Probability and Statistics	P	P	P					
19	CCS204	Database Fundamentals	P	P	P	P	P	P		
20	CCS205	Digital Logic Design	P	P	P	P	P	P		
21	FRCS202	Communication Skills	P						P	P
22	CCS211	Operating Systems	P	P	P	P	P	P		
23	CCS212	Data Structures and Algorithms	P	P	P		P		P	
24	CCS213	Web Development	P			P	P	P	P	
25	CCS214	Database Management Systems	P	P	P	P	P	P		
26	CCS215	Computer Organization and Architecture	P	P	P	P	P	P		
27	MAT202	Linear Algebra	P	P	P					
28	FCRM301	Research Methodology				P		P	P	P
29	CCS301	Information Security	P	P	P	P		P		P

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30	CCS302	Human-Computer Interaction	P			P			P	
31	CCS303	Software Engineering	P	P	P	P	P	P	P	P
32	CCS304	Artificial Intelligence	P	P	P	P		P		P
33	CCS305	Advanced Programming	P	P	P		P		P	
34	CCS306	Computational Theory	P	P	P	P				
35	FRCS301	Professional Ethics	P						P	P
36	CCS307	Project Management				P		P	P	P
37	CCS308	Mobile Applications Development	P			P	P	P	P	
38	CCS309	Compilers Design	P	P	P	P				
39	CCS310	Computer Graphics and Visualization	P	P		P		P		
40	CCS311	Algorithms and Analysis	P	P	P		P		P	
41	SCI-ELEC	Science Elective	P	P						
42	CCS401	Modeling and Simulation	M/A			M/A		M/A		
43	CCS402	Programming languages	M/A	M/A	M/A		M/A		M/A	

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		Techniques (Arduino)								
44	CS-ELEC1	Elective (1)	M/A	M/A		M/A		M/A	M/A	M/A
45	ENT401	Entrepreneurship	M/A						M/A	M/A
46	GP401	Graduation Project (1)				M/A		M/A	M/A	M/A
47	CCS403	Blockchain	M/A	M/A		M/A		M/A		M/A
48	CCS404	Cloud Computing and IoT	M/A	M/A		M/A		M/A		M/A
49	CS-ELEC2	Elective (2)	M/A	M/A		M/A		M/A	M/A	M/A
50	GP402	Graduation Project (2)				M/A		M/A	M/A	M/A
51	CSE401	Cryptography and Data Security	M/A	M/A	M/A	M/A		M/A		M/A
52	CSE402	Games Development	M/A	M/A	M/A	M/A	M/A	M/A	M/A	M/A
53	CSE403	Network Programming	M/A	M/A	M/A		M/A		M/A	
54	CSE404	Machine learning	M/A	M/A	M/A	M/A		M/A		M/A
55	CSE405	Data Mining and Data warehousing	M/A	M/A	M/A	M/A	M/A	M/A	M/A	M/A
56	CSE406	Big data and analytics	M/A	M/A	M/A	M/A		M/A		M/A
57	CSE407	Image Processing and Computer Vision	M/A	M/A		M/A		M/A		

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58	CSE408	Data Science	M/A	M/A	M/A	M/A		M/A		M/A
59	CSE-EL	Science Elective Courses:	M/A	M/A						
60	SCI201	General Physic	M/A	M/A						
61	SCI202	General Biology	M/A	M/A						
62	SCI203	General Chemistry	M/A	M/A						

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PILOs Definitions (for reference)

PILO Code	Description
A1	Demonstrate fundamental knowledge of computing, mathematics, algorithms and computer systems.
A2	Explain and relate advanced and emerging computing concepts, architectures, tools and technologies.
B1	Formulate and analyze computing problems and select appropriate models, tools and techniques.
B2	Design, evaluate and improve computing solutions considering quality, security, constraints and societal impact.
C1	Implement, test and debug software/system components using appropriate programming languages and development tools.
C2	Develop and integrate secure computing applications and services across platforms and environments.
D1	Communicate effectively and work independently or in teams to produce reports, presentations and project deliverables.
D2	Demonstrate ethical, legal and social responsibility and engage in research and life-long learning.

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