FACULTY OF COMPUTING

The faculty of computing aims at producing computer professionals and mathematicians who can meet the challenges of emerging international trends in information technology, mathematics and related disciplines. To achieve this objective, we have a team of highly qualified and dedicated faculty members. In addition to providing strong theoretical foundations, our academic programs place due emphasis on the applied aspects of the disciplines. For this purpose the Faculty has established a strong liaison with Research & Development organizations and industry.

We believe that academic excellence is not possible without a quality research environment. Therefore, high emphasis is placed on research. The Faculty comprises of three departments, the Department of Computer Science, the Department of Software Engineering and the Department of Mathematics. Both the Departments offer BS, MS and PhD programs with different specializations. There are over 1100 alumni of the faculty who are contributing effectively in the industry and academia, thus paying their due share towards national growth.


Capital University of Science & Technology
CUST

DEPARTMENT OF COMPUTER SCIENCE

The Department of Computer Science at Capital University of Science & Technology aims at providing education and training at all levels to contribute to the national pool of computer scientists who can meet the demands of the industry and the academia. While the BS program primarily focuses on training students who would assume the role of developers, designers, and architects of computing systems. The MS and the PhD programs focus on preparing researchers and academicians. The prospective practitioners in the field of Computer Science are provided with the necessary skills to construct reliable computing systems by applying scientific, engineering, and management skills, while the prospective researchers are put through rigorous training in the research methodologies. However, the design, the development, and the research activities are structured so as to supplement each other.

BS Computer Science

■ Program Educational Objectives (PEOs)

The BS(CS) program aims to produce leading professionals who will:

(i) Contribute competently in the computing industry by applying requisite technical skills.

(ii) Demonstrate advancement in computing profession by enhancing their knowledge and skills.

(iii) Demonstrate ethical values and contribute positively towards the society.

■ Program Learning Outcomes (PLOs)

At the time of graduation, the graduates of BS(CS) program will possess the following attributes

(i) **Academic Education:** To prepare graduates as computing professionals.

(ii) **Knowledge for Solving Computing Problems:** Apply computer science theory and software development fundamentals to produce computing-based solutions.

(iii) **Problem Analysis:** Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.

(iv) **Design/Development of Solutions:** Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the problem's discipline.

(v) **Modern Tool Usage:** Create, select , adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

(vi) **Individual and Team Work:** Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.

(vii) **Communication:** Communicate effectively, in a variety of professional contexts.

(viii) **Computing Professionalism and Society:** Recognize professional responsibilities and make informed judgments in computing practice based on legal principles.

(ix) **Ethics:** Understand and commit to professional ethics, responsibilities and norms of professional computing practice.

(x) **Lifelong Learning:** Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

■ Admission Requirements

(i) Higher Secondary School Certificate or equivalent securing at least 50% marks in aggregate with Mathematics.

(ii) CUST Admission Test/HEC Approved Test

■ Degree Requirements

Each candidate for the BS Computer Science degree is required to successfully earn 133 credit hours (Cr. Hrs.) as per the following detail:

	Area	Cr. Hrs.
a)	General Education	30
b)	Major Courses	73
c)	Allied Courses	12
d)	Elective Courses	09
e)	Capstone Project	06
f)	Internship	03
	Total	**133**

■ General Education (30 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Functional English	CSG1113	3
Expository Writing	CSG1123	3
Islamic Studies/Ethics	CSG1012	2
Ideology and Constitution of Pakistan	CSG1022	2
Personal Grooming	CSG2212	2
Applied Physics	CSG1312	2
Applied Physics Lab	CSG1311	1
Sociology	CSG1412	2
Calculus and Analytical Geometry	CSG1513	3
Discrete Structures	CSG1573	3
Applications of Information and Communication Technologies	CSG1612	2
Applications of Information and Communication Technologies Lab	CSG1611	1
Entrepreneurship	CSG2712	2
Civics and Professional Ethics	CSG2812	2

■ Major Courses (73 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Introduction to Programming	CS1133	3
Introduction to Programming Lab	CS1131	1

Object Oriented Programming	CS1143	3
Object Oriented Programming Lab	CS1141	1
Introduction to Database Systems	CS2313	3
Introduction to Database Systems Lab	CS2311	1
Digital Logic Design	CS2512	2
Digital Logic Design Lab	CS2511	1
Data Structures	CS2143	3
Data Structures Lab	CS2141	1
Introduction to Information Security and Forensics	CS3712	2
Introduction to Information Security and Forensics Lab	CS3711	1
Artificial Intelligence	CS3812	2
Artificial Intelligence Lab	CS3811	1
Computer Networks	CS2772	2
Computer Networks Lab	CS2771	1
Software Engineering	CS2223	3
Computer Organization and Assembly Language	CS2522	2
Computer Organization and Assembly Language Lab	CS2521	1
Operating Systems	CS3412	2
Operating Systems Lab	CS3411	1
Design and Analysis of Algorithms	CS3163	3
Human Computer Interaction	CS4272	2
Human Computer Interaction Lab	CS4271	1
Compiler Construction	CS4622	2
Compiler Construction Lab	CS4621	1
Database Management Systems	CS2322	2
Database Management Systems Lab	CS2321	1
Parallel and Distributed Computing	CS3432	2
Parallel and Distributed Computing Lab	CS3431	1
Theory of Automata and Formal Languages	CS3613	3
Computer Architecture	CS3512	2

Computer Architecture Lab	CS3511	1
Graph Algorithms	CS3283	3
Numerical Computing	CS3072	2
Numerical Computing Lab	CS3071	1
Web Application Development	CS3192	2
Web Application Development Lab	CS3191	1
Mobile Application Development	CS4192	2
Mobile Application Development Lab	CS4191	1
Financial Accounting	ACCS4003	3

■ Allied Courses (12 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Linear Algebra	MTCS1033	3
Probability and Statistics	MTCS2063	3
Multi-variate Calculus	MTCS2053	3
Technical & Business Writing	HMCS3033	3

■ Elective Courses (09 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Elective – I (Machine Learning)	CS4613	3
Elective – II (Blockchain Technology)	CS4573	3
Elective – III (Introduction to Data Warehousing)	CS4333	3

■ Capstone Project (06 Cr. Hrs)

After the completion of 90 Cr. Hrs. the students are required to demonstrate their practical skills in the field of computer science by designing and implementing a design project worth 6 Cr. Hrs. The project shall be completed in two parts as given bellow:

Course Title	Code	Cr. Hrs.
Design Project (Part-I)	CS4912	2
Design Project (Part-II)	CS4924	4

Internship

It is mandatory for every student to participate in a 6-8 weeks summer internship program following their 6^{th} semester or after the completion of 90 Cr. Hrs.

Course Title	Code	Cr. Hrs.
Internship	CS4103	3

Community Service (VIS4000)

Each student is required to complete 65 hours community work, usually after 1^{st} semester which would be a prerequisite to clear the student for the award of degree.

CGPA Requirement

A student is required to earn a minimum 2.00/4.00 CGPA on the completion of his/her degree requirements.

Program Duration

This is a four years degree program comprising of 8 semesters with a minimum of 133 Cr. Hrs. There will be a Fall and a Spring semester in each year. The summer semester will be utilized for internship or deficiency courses. The maximum duration to complete BS Computer Science degree is 07 years.

Note: Degree requirements may be modified from time to time as per the directions of the concerned regulatory body.

SCHEME OF STUDIES
BS Computer Science

☐ Semester-I (18 Cr. Hrs.)

Course Code	Course Title	Cr. Hrs.
CS1133	Introduction to Programming	3
CS1131	Introduction to Programming Lab	1
CSG1022	Ideology and Constitution of Pakistan	2
CSG1113	Functional English	3
CSG1513	Calculus and Analytical Geometry	3
CSG1612	Applications of Information and Communication Technologies	2
CSG1611	Applications of Information and Communication Technologies Lab	1
CSG1312	Applied Physics	2
CSG1311	Applied Physics Lab	1

☐ Semester-II (17 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
CS1143	Object Oriented Programming	3
CS1141	Object Oriented Programming Lab	1
CSG1123	Expository Writing	3
CSG1412	Sociology	2
CSG1573	Discrete Structures	3
MTCS1033	Linear Algebra	3
CSG1012	Islamic Studies/Ethics	2

☐ Semester-III (18 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
CS2143	Data Structures	3
CS2141	Data Structures Lab	1
MTCS2063	Probability and Statistics	3
CSG2212	Personal Grooming	2

CS2313	Introduction to Database Systems	3
CS2311	Introduction to Database Systems Lab	1
CS2512	Digital Logic Design	2
CS2511	Digital Logic Design Lab	1
CSG2712	Entrepreneurship	2

☐ **Semester-IV (17 Cr. Hrs)**

Course Code	Course Title	Cr. Hrs.
CS2223	Software Engineering	3
CS2322	Database Management Systems	2
CS2321	Database Management Systems Lab	1
CS2522	Computer Organization and Assembly Language	2
CS2521	Computer Organization and Assembly Language Lab	1
CS2772	Computer Networks	2
CS2771	Computer Networks Lab	1
CSG2812	Civics and Professional Ethics	2
MTCS2053	Multi-variate Calculus	3

☐ **Semester-V (18 Cr. Hrs)**

Course Code	Course Title	Cr. Hrs.
CS3163	Design and Analysis of Algorithms	3
CS3613	Theory of Automata and Formal Languages	3
CS3412	Operating Systems	2
CS3411	Operating Systems Lab	1
CS3712	Introduction to Information Security and Forensics	2
CS3711	Introduction to Information Security and Forensics Lab	1
CS3512	Computer Architecture	2
CS3511	Computer Architecture Lab	1
CS3283	Graph Algorithms	3

☐ **Semester-VI (15 Cr. Hrs)**

Course Code	Course Title	Cr. Hrs.
CS3432	Parallel and Distributed Computing	2
CS3431	Parallel and Distributed Computing Lab	1
CS3812	Artificial Intelligence	2
CS3811	Artificial Intelligence Lab	1
HMCS3033	Technical & Business Writing	3
CS3192	Web Application Development	2
CS3191	Web Application Development Lab	1
CS3072	Numerical Computing	2
CS3071	Numerical Computing Lab	1

☐ **Semester-VII (17 Cr. Hrs)**

Course Code	Course Title	Cr. Hrs.
CS4622	Compiler Construction	2
CS4621	Compiler Construction Lab	1
CS4912	Mobile Application Development	2
CS4911	Mobile Application Development Lab	1
CS4613	Machine Learning	3
CS4272	Human Computer Interaction	2
CS4271	Human Computer Interaction Lab	1
CS4912	Design Project (Part-I)	2
CS4573	Blockchain Technology	3

☐ **Semester-VIII (10 Cr. Hrs)**

Course Code	Course Title	Cr. Hrs.
CS4924	Design Project (Part-II)	4
CS4333	Introduction to Data Warehousing	3
ACCS4003	Financial Accounting	3

MS Computer Science

Admission Requirements

(i) A minimum of 16 years of education leading to BS in Computer Science/Information Technology/Software Engineering or equivalent

(ii) Minimum 2.00/4.00 CGPA or 50% marks

(iii) Admission Test/HEC Approved Test

Degree Requirements

A student admitted in this program will have to complete the degree requirements by following any one of the options given below:

(i) 24 Cr. Hrs course work with 6 Cr. Hrs Thesis

(ii) 30 Cr. Hrs. course work only (10 Courses)

Core Courses (12 Cr. Hrs.)

Students are required to qualify all the core courses listed below:

Course Title	Code	Cr. Hrs.
Advanced Analysis of Algorithms	CS5123	3
Advanced Computer Architecture	CS5413	3
Advanced Operating Systems	CS5433	3
Advanced Theory of Computation	CS5113	3

Elective Courses – with / without thesis (12/18 Cr. Hrs.)

a) Software Engineering

Course Title	Code	Cr. Hrs.
Advanced Software Architecture	CS5213	3
Requirements Engineering	CS5253	3
Software Engineering Processes	CS5263	3
Software Risk Management	CS6243	3
Semantic Computing	CS6113	3
Formal Methods in Software Engineering	CS5623	3
Model and Specification Based Software Testing	CS5633	3
Ontology Engineering	CS6143	3
Safety-critical Systems	CS6213	3
Software Fault Tolerance	CS6223	3

Advanced Software Testing	CS6233	3
Advanced Software Engineering	CS6263	3
Special Topics in Software Systems & Engineering	CS6xx3	3
Advanced Software Project Management	CS5373	3
Advanced Software Quality Assurance	CS6283	3
Secured Software Development	CS5643	3
Advanced Usability Engineering	CS5653	3

b) Computer Networks

Course Title	Code	Cr. Hrs.
Multimedia Services over IP Networks	CS6523	3
Advanced Computer Networks	CS6713	3
Internet Protocols	CS5723	3
Network Programming	CS5733	3
Mobile and Wireless Networks	CS6723	3
Network Security	CS5713	3
Topics in Computer Networks	CS6733	3

c) Artificial Intelligence

Course Title	Code	Cr. Hrs.
Advance Artificial Intelligence	CS5523	3
Pattern Recognition	CS5533	3
Artificial Neural Networks	CS6533	3
Digital Image Processing	CS5553	3
Natural Language Processing	CS5563	3
Text Mining and Information Retrieval	CS5573	3
Decision Support and Expert Systems	CS6563	3
Intelligent Systems	CS5583	3
Fuzzy Systems	CS5533	3
Advance Statistical Analysis	CS6543	3
Knowledge Graph based Systems	CS6553	3

d) Data Science

Course Title	Code	Cr. Hrs.
Data Mining	CS5343	3
Modeling and Optimization	CS6613	3
Advanced Data Mining	CS6333	3
Data Warehousing	CS5333	3
Distributed Database Systems	CS5323	3
Decision Support Systems	CS5923	3
Web Mining	CS6323	3
Advanced Topics in Data Mining	CS6313	3
Data Visualization	CS5963	3
Algorithms for Data Science	CS5973	3
Statistics for Data Science	CS5983	3
Machine Learning for Data Science	CS5993	3
Semantics for Big Data	CS5833	3
Graph Analytics	CS5843	3
Ontologies for Big Data	CS5853	3
Data Mining of Healthcare Analytics	CS5813	3
Healthcare Data Acquisition	CS5853	3
Embedded Systems for Healthcare	CS5173	3
Internet of Things for Healthcare	CS5143	3

e) Information Security

Course Title	Code	Cr. Hrs.
Network Security	CS5713	3
Computer Security	CS5753	3
Electronic Warfare – Principles and Techniques	CS5763	3
Cloud Computing Security	CS5773	3
Advanced Cryptography	CS5783	3
Digital Forensics	CS5793	3

Applied Cryptography	CS5953	3
Crypto Analysis	CS6833	3
Cyber Attacks – Modeling and Analysis	CS6843	3
Information Security Policy and Management	CS6853	3
Cyber Forensics and Incident Response	CS6863	3
Semantics for Information Security	CS6873	3

Research Thesis

Course Title	Code	Cr. Hrs.
Research Thesis	CS6916	6

CGPA Requirement

A student is required to earn a minimum 3.00/4.00 CGPA on the completion of his/her degree requirements.

Program Duration

This is normally a two years program comprising of 4 semesters with minimum of 30 semester credit hours. There will be a Fall and a Spring Semester in each year. The maximum duration to complete MS in Computer Science is 4 years.

PhD Computer Science

The Department provides a vibrant and dynamic environment that encourages excellence in research specifically in the areas of Software Engineering, Computer Networks, Web and Information Systems, Data Science and Information Security. The PhD program aims at producing graduates who could meet the challenges of emerging international trends in Computer Science. To achieve this objective, we have a team of highly qualified and dedicated faculty members; a cohesive and carefully designed PhD program. A due emphasis has been placed on the applied and industrial aspects of the research. For this purpose, the Department has established a strong liaison with Research & Development organizations and industry.

■ Admission Requirements

(i) MS degree in relevant discipline

(ii) Minimum CGPA 3.0/4.0 (Semester System) or 60% marks (Annual System)

(iii) Admission Test/GAT General/HEC Test

(iv) Interview

■ Degree Requirements

A PhD candidate shall be awarded degree on successful completion of the following requirements:

(i) 18 Cr. Hrs. Course Work with minimum CGPA 3.00/4.00

(ii) Comprehensive Examination

(iii) 30 Cr. Hrs. Research Work

(iv) Synopsis Defense

(v) Dissertation Foreign Reviews

(vi) Publication of at least one research paper in HEC approved journal.

(vii) Dissertation Final Defense

Note: PhD scholars are required to comply with the following timeline:

Activity	Preferred Time	Maximum
Course Work	2 Semesters	3 Semesters
Comprehensive Exam	3 Semesters	4 Semesters
Synopsis Qualification	4 Semesters	6 Semesters
Thesis Submission	6 Semesters	12 Semesters