

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.



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 137 credit hours (Cr. Hrs.) as per the following detail:

Area	Cr. Hrs.
a) General Education	34
b) Major Courses	73
c) Allied Courses	12
d) Elective Courses	09
e) Capstone Project	06
f) Internship	03
Total	137

■ General Education (34 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
Fehm-ul-Quran I	CSG1021	1
Fehm-ul-Quran II	CSG1031	1
Pakistan Studies	CSG1032	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 6th 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 1st 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 137 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 Analytic Geometry	3
CSG1612	Application of Information & Communication Technologies	2
CSG1611	Application of Information & Communication Technologies Lab	1

□ Semester-II (17 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
CS1143	Object Oriented Programming	3
CS1141	Object Oriented Programming-Lab	1
CSG1312	Applied Physics	2
CSG1311	Applied Physics Lab	1
CSG1123	Expository Writing	3
CSG1412	Sociology	2
CSG1573	Discrete Structures	3
CSG1012	Islamic Studies/Ethics	2
CSG1021	Fehm-ul-Quran I	1

□ Semester-III (18 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
CS2143	Data Structures	3
CS2141	Data Structures Lab	1
CS2313	Introduction to Database Systems	3
CS2311	Introduction to Database Systems Lab	1
MTC2033	Linear Algebra	3
CSG2212	Personal Grooming	2

CS2512	Digital Logic Design	2
CS2511	Digital Logic Design Lab	1
CSG2031	Fehm-ul-Quran II	1

□ Semester-IV (17 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
CS2522	Computer Organization and Assembly Language	2
CS2521	Computer Organization and Assembly Language Lab	1
CSG2712	Entrepreneurship	2
CS2322	Database Management Systems	2
CS2321	Database Management Systems Lab	1
CSG2032	Pakistan Studies	2
MTCS2063	Probability & Statistics	3
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
CS3412	Operating Systems	2
CS3411	Operating Systems Lab	1
CS3223	Software Engineering	3
CS3772	Computer Networks	2
CS3771	Computer Networks Lab	1
CS3283	Graph Algorithm	3
CS3512	Computer Architecture	2
CS3511	Computer Architecture Lab	1

□ Semester-VI (15 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
CS3432	Parallel and Distributing Computing	2
CS3431	Parallel and Distributing Computing Lab	1
CS3812	Artificial Intelligence	2

CS3811	Artificial Intelligence Lab	1
HMCS3033	Technical and Business Writing	3
CS3192	Web Application Development	2
CS3191	Web Application Development Lab	1
CS3712	Introduction to Information Security and Forensics	2
CS3711	Introduction to Information Security and Forensics Lab	1

□ **Semester-VII (17 Cr. Hrs)**

Course Code	Course Title	Cr. Hrs.
CS4072	Numerical Computing	2
CS4071	Numerical Computing Lab	1
CS4912	Mobile Application Development	2
CS4911	Mobile Application Development Lab	1
CS4613	Machine Learning (Elective - I)	3
CS4272	Human Computer Interaction	2
CS4271	Human Computer Interaction Lab	1
CS4912	Design Project 1	2
CS4613	Theory of Automata and Formal Languages	3

□ **Semester-VIII (10 Cr. Hrs)**

Course Code	Course Title	Cr. Hrs.
CS4924	Design Project 2	4
CS4333	Introduction to Data Warehousing (Elective - III)	3
CS4622	Compiler Construction	2
CS4621	Compiler Construction Lab	1
ACCS4003	Financial Accounting	3
CS4573	Blockchain Technology (Elective - II)	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

■ General Education (02 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Fehm-ul-Quran I	CSG7021	1
Fehm-ul-Quran II	CSG7031	1

■ 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	CS7123	3
Advanced Computer Architecture	CS7413	3
Advanced Operating Systems	CS7433	3
Advanced Theory of Computation	CS7113	3

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

a) Software Engineering

Course Title	Code	Cr. Hrs.
Advanced Software Architecture	CS7213	3
Requirements Engineering	CS7253	3
Software Engineering Processes	CS7263	3
Software Risk Management	CS8243	3
Semantic Computing	CS7113	3
Formal Methods in Software Engineering	CS7623	3

■ 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 2 Cr. Hrs. Fehm-ul-Quran and 6 Cr. Hrs. Thesis
- (ii) 30 Cr. Hrs. course work (10 courses) with 2 Cr. Hrs. Fehm-ul-Quran

Model and Specification Based Software Testing	CS7633	3
Ontology Engineering	CS8143	3
Safety-critical Systems	CS8213	3
Software Fault Tolerance	CS8223	3
Advanced Software Testing	CS8233	3
Advanced Software Engineering	CS8263	3
Special Topics in Software Systems & Engineering	CS8xx3	3
Advanced Software Project Management	CS7373	3
Advanced Software Quality Assurance	CS8283	3
Secured Software Development	CS7643	3
Advanced Usability Engineering	CS7653	3

b) Computer Networks

Course Title	Code	Cr. Hrs.
Multimedia Services over IP Networks	CS8523	3
Advanced Computer Networks	CS8713	3
Internet Protocols	CS7723	3
Network Programming	CS7733	3
Mobile and Wireless Networks	CS8723	3
Network Security	CS7713	3
Topics in Computer Networks	CS8733	3

c) Artificial Intelligence

Course Title	Code	Cr. Hrs.
Advance Artificial Intelligence	CS7523	3
Pattern Recognition	CS7533	3
Artificial Neural Networks	CS8533	3
Digital Image Processing	CS7553	3
Natural Language Processing	CS7563	3
Text Mining and Information Retrieval	CS7573	3
Decision Support and Expert Systems	CS8563	3
Intelligent Systems	CS7583	3

Fuzzy Systems	CS7533	3
Advance Statistical Analysis	CS8543	3
Knowledge Graph based Systems	CS8553	3

d) Data Science

Course Title	Code	Cr. Hrs.
Data Mining	CS5343	3
Modeling and Optimization	CS6613	3
Advanced Data Mining	CS8333	3
Data Warehousing	CS7333	3
Distributed Database Systems	CS7323	3
Decision Support Systems	CS7923	3
Web Mining	CS8323	3
Advanced Topics in Data Mining	CS8313	3
Data Visualization	CS7963	3
Algorithms for Data Science	CS7973	3
Statistics for Data Science	CS7983	3
Machine Learning for Data Science	CS7993	3
Semantics for Big Data	CS7833	3
Graph Analytics	CS7843	3
Ontologies for Big Data	CS7853	3
Data Mining of Healthcare Analytics	CS7813	3
Healthcare Data Acquisition	CS7853	3
Embedded Systems for Healthcare	CS7173	3
Internet of Things for Healthcare	CS7143	3

e) Information Security

Course Title	Code	Cr. Hrs.
Network Security	CS7713	3
Computer Security	CS7753	3
Electronic Warfare – Principles and Techniques	CS7763	3
Cloud Computing Security	CS7773	3

Advanced Cryptography	CS7783	3
Digital Forensics	CS7793	3
Applied Cryptography	CS7953	3
Crypto Analysis	CS8833	3
Cyber Attacks – Modeling and Analysis	CS8843	3
Information Security Policy and Management	CS8853	3
Cyber Forensics and Incident Response	CS8863	3
Semantics for Information Security	CS8873	3

■ Research Thesis

Course Title	Code	Cr. Hrs.
Research Thesis	CS8916	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 32 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) 2 Cr. Hrs. Fehm-ul-Quran
- (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