Annexure-I
Study Schema of Bachelor of Science in Computer Science BS (CS)
(Fall 2025)

Introduction

Computer science is the study of the theory, experimentation, and engineering that form the basis for the design and use of computers. It is the scientific and practical approach to computation and its applications and the systematic study of the feasibility, structure, expression, and mechanization of the methodical procedures (or algorithms) that underlie the acquisition, representation, processing, storage, communication of, and access to information [ref WordNet Princeton definition].

Computer Science is the application of a systematic, disciplined, and quantifiable approach to the design, development, operation, and maintenance of software systems. It is in fact the practice of designing and implementing large, reliable, efficient, and economical software by applying the principles and practices of engineering. The program aims to train students in all aspects of software life cycle from specification through analysis and design to testing, maintenance and evaluation of software products.

Computer Science spans a wide range, from its theoretical and algorithmic foundations to cutting edge developments in robotics, computer vision, intelligent systems, bioinformatics, and other exciting areas. The overall scope of Computer Science may be viewed into the following three categories:

- To develop effective ways to solve computing problems. For example, Computer Science develops the best possible ways to store information in databases, send data over networks, and display complex images. The theoretical background offered by Computer Science allows determining the best performance possible, and their study of algorithms. It enables us to develop new problem-solving approaches that provide better performance.

- It devises new ways to use computers intelligently and effectively. Progress in the areas of networking, database, and human-computer-interface came together because of the world wide web, which changed the entire world. Now, researchers are working to make robots that are practical aides and demonstrate intelligence, databases that create new knowledge and, in general, use computers to do new things.

- It deals with the design and implementation of software systems. Computer Science provides training and skills for the successful implementation of software systems that solve challenging programming jobs. Computer Science spans the range from theory to models, design, and programming. Computer Science offers a comprehensive foundation that permits graduates to adapt to new technologies and new ideas.

Eligibility Criteria

The minimum requirements for admission in the program are any of following:
(a) At least 50% marks in Intermediate (HSSC) examination with Mathematics
or equivalent qualification with Mathematics, certified by IBCC.
OR
(a) At least 50% marks in the Intermediate (HSSC) examination with Pre-Engineering, Pre-Medical or
equivalent qualification, certified by IBCC.

Deficiency:
"Students with pre-medical, must have to pass deficiency courses of Mathematics of 6 credit hours in first two semesters."

Duration

The minimum duration for completion of the degree is four years. The HEC allows a maximum period of seven years to complete BS degree requirements.

Degree Completion Requirements

To become eligible for award of BS degree, a student must satisfy the following requirements:
a) Must have studied and passed the prescribed courses, totaling at least 134 credit hours.
b) Must have earned CGPA (Cumulative Grade Point Average) of at least 2.0 on a scale of 4.0.

Program Learning Outcome (PLOs) / Graduate Attributes (GAs)

This degree program prepares students to attain educational objectives by ensuring that students demonstrate achievement of the following outcomes (derived from Graduate Attributes defined by Seoul Accord www.seoulaccord.org).

S. No.	Graduate Attributes (GAs)	Computing Professional Graduate Outcomes
1	Academic Education	To prepare graduates as AI professionals
2	Knowledge for Solving Computing Problems	Apply knowledge of CS, knowledge of a CS specialization, and mathematics, science, and domain knowledge appropriate for the CS specialization to the abstraction and conceptualization of CS models from defined problems and requirements
3	Problem Analysis	Identify, formulate, research literature, and solve complex CS-related problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines
4	Design/ Development of Solutions	Design and evaluate solutions for complex CS problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations
5	Modern Tool Usage	Create, select, adapt, and apply appropriate techniques, resources, and modern computing tools to complex CS activities, with an understanding of the limitations
6	Individual and Team Work	Function effectively as an individual and as a member or leader in diverse teams and in multi-disciplinary settings
7	Communication	Communicate effectively with the computing community and with society at large about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions
8	CS Professionalism and Society	Understand and assess societal, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional CS practice
9	Ethics	Understand and commit to professional ethics, responsibilities, and norms of professional CS practice
10	Life-long Learning	Recognize the need, and have the ability, to engage in independent learning for continual development as a CS professional

Program Educational Objectives (PEOs)

1. Adequate Domain Knowledge: To produce graduates who possess adequate knowledge and skills to qualify to become competent applications developer, database programmer/designer, systems developer / analyst or network administrator/manager etc.
2. Critical Analysis and Problem Solution: To produce graduates who can critically analyze a problem, and develop appropriate computer-based solution by identifying the computing requirements for that solution.
3. Multidisciplinary Approach: To familiarize graduates with multi-disciplinary work styles and equip them with sufficient domain knowledge of relevant disciplines.
4. Aware of state-of-the-art Technologies: To produce graduates well aware of technological advancements in the field of computer science that enable them to employ them in their technological domains.
5. Effective Communication: To produce graduates who can effectively communicate their ideas and work, both orally and in writing.
6. Ethical and Society Values: To produce graduates well aware of professional, ethical, legal, security, and the impact of their work on society & the environment.

Graduate Attributes (GAs) – Program Educational Outcomes (PEOs) Mapping

PEOs	Graduate Attributes (GAs)									
	GA 1	GA 2	GA 3	GA 4	GA 5	GA 6	GA 7	GA 8	GA 9	GA 10
PEO 1	*	*	*	*	-	-	-	-	-	*
PEO 2	-	-	*	*	-	-	-	-	-	-
PEO 3	-	-	-	-	-	*	-	-	-	-
PEO 4	-	-	-	*	*	-	-	-	-	-
PEO 5	-	-	-	-	-	*	*	-	-	-
PEO 6	-	-	-	-	-	-	-	*	*	*

*represents applicable and -represents not applicable

Curriculum Design

The structure of BS in CS program is proposed to meet the needs of students through theory and practical experience. The students are expected to learn theoretical and practical understanding of CS and its sub-domains.
The proposed structure is dynamic and provides basis for various options including Breadth-Based, Depth-Based, and Integrated Breadth & Depth Based specializations. Students may choose a particular option, which is most appropriate to their planned future career. The following are some relevant details:

- Minimum credit hours shall be 134 for BS (CS) program.
- The program comprises eight semesters spread over four years.
- The following table gives the distribution of credit hours in different knowledge domains.

Generic Structure of Computing Discipline

Areas	Credit Hours	Courses
Computing Core	46	14
Domain Core	18	6
Domain Electives	21	7
Mathematics & Supporting Courses	12	4
Elective Supporting Courses	3	1
General Education Requirements	34	15
Totals	**134**	**47**

Mapping of BSCS Program on the Generic Structure

S. No	Semester	Code	Pre-Req	Course Title	Domain	Credit Hours
Computing Core (46/134) 14 Courses						
1	1	CS102		Programming Fundamentals	Core	4(3-3)
2	2	CS150	PF	Object Oriented Programming	Core	4(3-3)
3	2	CS151		Database Systems	Core	4(3-3)
4	3	CS202		Digital Logic Design	Core	3(2-3)
5	3	CS201	PF	Data Structures	Core	4(3-3)
6	4	CS254		Information Security	Core	3(3-0)
7	4	CS253		Artificial Intelligence	Core	3(2-3)
8	3	CS2xx		Computer Networks	Core	3(2-3)
9	3	CS204		Software Engineering	Core	3(3-0)
10	4	CS250	DLD	Computer Organization & Assembly Language	Core	3(2-3)
11	5	CS301		Operating Systems	Core	3(2-3)
12	6	CS352	DS	Analysis of Algorithm	Core	3(3-0)
13	7	CS401		Final Year Project-I	Core	2(0-4)
14	8	CS450	FYP-I	Final Year Project-II	Core	4(0-12)
Domain Core (18/134) 6 Courses						
15	4	CS250		Theory of Automata	Domain Core	3(3-0)
16	4	CS252	DB	Advance Database Management Systems	Domain Core	3(2-3)
17	6	CS350		HCI & Computer Graphics	Domain Core	3(2-3)
18	5	CS303		Computer Architecture	Domain Core	3(3-0)
19	5	CS302		Compiler Construction	Domain Core	3(2-3)
20	6	CS351		Parallel & Distributed Computing	Domain Core	3(2-3)
Mathematics & Supporting Courses (12/134) 4 Courses						
21	3	MT201	CAG	Multivariate Calculus	Maths	3(3-0)
22	5	MT301	CAG	Linear Algebra	Maths	3(3-0)
23	4	MT250		Probability & Statistics	Maths	3(3-0)
24	6	EN350	FE	Technical & Business Writing	EN	3(3-0)
General Education Requirement as per HEC UG Education Policy (34/134) 15 Courses						
25	1	GE101		Application of Information & Communication Technologies	GER	3(2-3)

26	1	GE105		Functional English	GER	3(3-0)
27	2	GE152	ECC / FE	Expository Writing	GER	3(3-0)
28	1	GE104		Quantitative Reasoning – 1 (Discrete Structures)	GER	3(3-0)
29	2	GE151		Quantitative Reasoning – 2 (Calculus and Analytic Geometry)	GER	3(3-0)
30	1	GE102		Islamic Studies	GER	2(2-0)
31	1	GE106		Pakistan Studies	GER	2(2-0)
32	2	GE153/ GE154		Fehm-e-Quran I / Comparative Religion - I	GER	1 (0-1)
33	4	GE253/ GE254		Fehm-e-Quran II / Comparative Religion – II	GER	1 (0-1)
34	3	GE201		Ideology and Constitution of Pakistan	GER	2(2-0)
35	8	GE450		Social Sciences (Example: Introduction to Management)	GER	2(2-0)
36	2	GE150		Natural Sciences (Applied Physics)	GER	3(2-3)
37	8	GE451		Arts & Humanities (Professional Practices)	GER	2(2-0)
38	8	GE452		Civics and Community Engagement	GER	2(2-0)
39	7	GE401		Entrepreneurship	GER	2(2-0)
List of Elective Supporting Courses (3/134) 1 Course						
40	7	SS401		Social Science (Example: Introduction to Marketing)	SS	3(3-0)
41		SS4xx		Social Science (Example: Financial Accounting)	SS	3(3-0)
42		SS4xx		Research Methods	SS	3(3-0)
43		SS4xx		Organizational Behavior	SS	3(3-0)
44		SS4xx		International Relations	SS	3(3-0)
45						
46						
47						
48						
Domain Elective (21/134) 7 Courses						
49	5	CS3xx		Web technologies	Domain Elec	3(2-3)
50	5	CS3xx		Mobile Application Development 1	Domain Elec	3(2-3)
51	6	CS3xx		Mobile Application Development 2	Domain Elec	3(3-0)
52	6	CS3xx		Advanced Programming (Old Name: Visual Programming)	Domain Elec	3(2-3)
53	6	CS3xx		Web Engineering	Domain Elec	3(2-3)
54	6	CS3xx		Cyber Security	Domain Elec	3(2-3)
55	7	CS4xx		Software Testing & Quality Assurance	Domain Elec	3(2-3)
56		CSxxx		Cloud Computing	Domain Elec	3(2-3)
57		CSxxx		Computer Graphics	Domain Elec	3(2-3)
58		CSxxx		Object Oriented Analysis & Design	Domain Elec	3(2-3)
59		CSxxx		Natural Language Processing	Domain Elec	3(2-3)
60		CSxxx		Speech Processing	Domain Elec	3(2-3)
61		CSxxx		Data Mining	Domain Elec	3(2-3)
62		CSxxx		Advanced Statistics	Domain Elec	3(3-0)
63		CSxxx		Reinforcement Learning	Domain Elec	3(2-3)
64		CSxxx		Theory of Automata	Domain Elec	3(2-3)
65		CSxxx		HCI & Computer Graphics	Domain Elec	3(2-3)
66		CSxxx		Fuzzy Systems	Domain Elec	3(2-3)
67		CSxxx		Swarm Intelligence	Domain Elec	3(2-3)

68		CSxxx		Agent Based Modeling	Domain Elec	3(2-3)
69		CSxxx		Knowledge Based Systems	Domain Elec	3(2-3)
70		CSxxx		Front-end Development Technologies	Domain Elec	3(2-3)
71		CSxxx		Back-end Technologies	Domain Elec	3(2-3)
72		CSxxx		Full Stack Development	Domain Elec	3(2-3)
73		CSxxx		MERN Stack Development	Domain Elec	3(2-3)
74		CSxxx		DevOps	Domain Elec	3(2-3)
75		CSxxx		Data Science	Domain Elec	3(2-3)
76		CSxxx		Computer Vision	Domain Elec	3(2-3)
77		CSxxx		Digital Image Processing	Domain Elec	3(2-3)
78		CSxxx		MLOPs	Domain Elec	3(2-3)
79		CSxxx		Business Intelligence	Domain Elec	3(2-3)
80		CSxxx		E-Commerce and Digital Marketing	Domain Elec	3(2-3)
81		CSxxx		Mobile Application Development	Domain Elec	3(2-3)
82		CSxxx		Large Language Models	Domain Elec	3(2-3)
83		CSxxx		MLOps	Domain Elec	3(2-3)
84		CSxxx		Software Verification and Validation (Testing & QA)	Domain Elec	3(2-3)
85		CSxxx		Software Re-Engineering	Domain Elec	3(2-3)
86		CSxxx		Robotics	Domain Elec	3(2-3)
87		CSxxx		Generative AI	Domain Elec	3(2-3)
88		CSxxx		Explainable AI	Domain Elec	3(2-3)
89		CSxxx		Information Design	Domain Elec	3(2-3)
90		CSxxx		Blockchain Technologies	Domain Elec	3(3-0)
91		CSxxx		Graph Theory	Domain Elec	3(3-0)
92						
93						
94						
95						
96						
97						
98						
99						
100						

Semester-wise Plan of BS in Computer Science Program

Semester-I					
S No	**Course Code**	**Pre-Req**	**Course Title**	**Domain**	**Credit Hours**
1	CS102		Programming Fundamentals	Core	4 (3-3)
2	GE101		Application of Information and Communication Technologies	General	3 (2-3)
3	GE102/GE103		Islamic Studies / Ethics	General	2 (2-0)
4	GE106		Pakistan Studies	General	2 (2-0)
5	GE104		Discrete Structures	General	3 (3-0)
6	GE105		Functional English	General	3 (3-0)
7	MT101		Additional Math-I	Non-Credit	0 (0-0)
				Total Credit Hours	**17 (15-6)**

Semester-II					
S No	**Course Code**	**Pre-Req**	**Course Title**	**Domain**	**Credit Hours**
1	CS150	PF- CS102	Object Oriented Programming	Core	4 (3-3)
2	CS151		Database Systems	Core	4 (3-3)
3	GE150		Applied Physics	General	3 (2-3)
4	GE151		Calculus and Analytic Geometry	General	3 (3-0)
5	GE152	FE- GE105	Expository Writing	Core	3 (3-0)
6	MT150		Additional Math-II	Non-Credit	0 (0-0)
7	GE153/ GE154		Fehm-e-Quran I / Comparative Religion - I	General	1 (0-1)
				Total Credit Hours	**18 (14-10)**

Semester-III					
S No	**Course Code**	**Pre-Req**	**Course Title**	**Domain**	**Credit Hours**
1	CS201	PF- CS102	Data Structures	Core	4 (3-3)
2	MT201	CAG-GE151	Multivariate Calculus	Maths	3 (3-0)
3	CS202		Digital Logic Design	Core	3 (2-3)
4	CS203		Computer Networks	Core	3 (2-3)
5	CS204		Software Engineering	Core	3 (3-0)
6	GE201		Ideology and Constitution of Pakistan	General	2 (2-0)
				Total Credit Hours	**18 (15-9)**

Semester-IV					
SNo	**Course Code**	**Pre-Req**	**Course Title**	**Domain**	**Credit Hours**
1	CS250	DLD- CS202	Computer Organization and Assembly Language	Core	3 (2-3)
2	CS251		Theory of Automata	Domain Core	3 (3-0)
3	CS252	DB-CS151	Advanced Database Management Systems	Domain Core	3 (2-3)
4	CS253		Artificial Intelligence	Core	3 (2-3)
5	CS254		Information Security	Core	3 (3-0)
6	MT250		Probability and statistics	Maths	3 (3-0)
7	GE253/ GE254		Fehm-e-Quran - II / Comparative Religion - II	General	1 (0-1)
				Total Credit Hours	**19 (15-10)**

Semester-V					
S No	**Course Code**	**Pre-Req**	**Course Title**	**Domain**	**Credit Hours**
1	CS301		Operating Systems	Core	3 (2-3)
2	CS302	TA- CS251	Compiler Construction	Domain Core	3 (2-3)
3	CS303	COAL-CS250	Computer Architecture		3 (3-0)
4	CS3xx		Elective-1	Domain Elective	3 (2-3)
5	CS3xx		Elective-II	Domain Elective	3 (2-3)
6	MT301	CAG-GE151	Linear Algebra	Maths	3 (3-0)
				Total Credit Hours	**18 (14-12)**

Semester-VI					
S No	**Course Code**	**Pre-Req**	**Course Title**	**Domain**	**Credit Hours**
1	CS350		HCI and Computer Graphics	Domain Core	3 (2-3)
2	CS351	OS- CS301	Parallel & Distributed Computing	Domain Core	3 (2-3)
3	CS3xx		Elective-III	Domain Elective	3 (2-3)
4	CS3xx		Elective-1V	Domain Elective	3 (2-3)
	CS352	DS- CS201	Analysis of Algorithms	Core	3 (3-0)
	EN350		Technical & Business Writing	EN	3 (3-0)
				Total Credit Hours	**18 (14-12)**

Semester-VII					
S No	**Course Code**	**Pre-Req**	**Course Title**	**Domain**	**Credit Hours**
1	CS401		Final Year Project – I	Core	2 (0-6)
2	CS4xx		Elective-V	Domain Elective	3 (2-3)
3	CS4xx		Elective-VI	Domain Elective	3 (2-3)
4	CS4xx		Elective-VII	Domain Elective	3 (2-3)
5	SS401		Elective Supporting Course (Example: Introduction to Marketing)	SS	3 (3-0)
6	GE401		Entrepreneurship	General	2 (2-0)
				Total Credit Hours	**16 (11-15)**

Semester-VIII					
S No	**Course Code**	**Pre-Req**	**Course Title**	**Domain**	**Credit Hours**
1	CS450		Final Year Project - II	Core	4 (0-12)
2	GE450		Social Science-I (Example: Introduction to Management)	General	2 (2-0)
3	GE451		Arts & Humanities (Professional Practices)	General	2 (2-0)
4	GE452		Civics and Community Engagement	General	2 (2-0)
				Total Credit Hours	**10 (6-12)**