



Kohsar University, Murree

1. Scheme of Study for BS(CS) Fall 2022 onwards

Curriculum for BS Computer Science Program

BS(CS) Program Rationale

Computer Science is the systematic study of the feasibility, structure, expression, and mechanization of the methodical processes (or algorithms) that underlie the acquisition, representation, processing, storage, communication of, and access to information, whether such information is encoded in bits and bytes in a computer memory or transcribed in genes and protein structures in a human cell.

Computer Science spans a wide range, from its theoretical and algorithmic foundations to cutting-edge developments in robotics, computer vision, intelligent systems, bioinformatics, image processing, computational biology, computational lenses, and other exciting areas. Computer scientists develop new programming approaches for software development, devise new ways to use computers and develop effective ways to solve computing problems. While other disciplines produce graduates with more immediately relevant job-related skills, computer science offers a comprehensive foundation for research and innovation.

Recent developments in computer hardware, software and communication technologies have offered new exciting opportunities and challenges for creation of innovative learning environments for Computer Science and its curricula design. The challenge of getting all newly emerging technologies incorporated into the curriculum is becoming pivotal for the effectiveness of curricula. There is a need for curricula structures that are really able to meet the challenges of 21st century knowledge driven complex workplaces. The key rationale behind the BS Computer Science program is to prepare a curriculum that provide integration of all components and the foundations that allow accessing all of the new knowledge and technology to fulfil the vision of future.

Program Aims & Objectives

BSCS Program is committed to create, expand, disseminate, and teach the computer science body of knowledge through academics, applications and research which positively impact society locally, nationally, and internationally.

BSCS program aims to develop students' critical professional thinking and intuition. The program 's curriculum provides a balanced mixture of learning experiences to make the graduates capable of sound professional decisions. As a result, the successful graduates will be able to assume responsible positions in business, government, and education at the research, development, and planning levels. The program also provides an excellent foundation for further formal learning and training. The program is also expected to provide environments to put into practice, the principles and techniques learnt during the course of implementation of the program curriculum. Some of the key objectives of the program are listed below:

- The program should provide a broad understanding of the field through introducing concepts, theory, techniques, and through intensive education/training in focused areas of Computer Science.
- The program should encourage students to develop and use abstract models in addition to apply respective technology in practical situations.
- The program should promote students' special communication skills both orally and in writing.
- They must be able to produce well-organized reports/presentations/projects, which clearly delineate objectives, methods of solution, results, and conclusions for a complex task.
- The program should provide formal foundations for higher learning and education.
- The program should be dynamic and flexible enough to maintain its body of knowledge in line with the latest scientific and technological developments in the field.
- The program should provide professional orientation to prepare students for industry.

Program Outcome

The program will produce Computer Scientists of great character, competence, vision and drive equipped with up-to-date knowledge, marketable skills, valuable competencies, unique expertise, globally compatible dispositions and culturally and professionally acceptable values to take on appropriate professional roles in computer science domain or proceed to further or higher education or training.

Program Structure

The structure of a BS Computer Science program meets the needs of students with formal computing experience and relevant skills. The students are expected to learn theoretical and practical understanding of the entire field of Computer Science. The program structure is dynamic and provides basis for various options including Breadth-Based, Depth-Based, and Integrated Breadth & Depth-Based specializations. Student may choose a particular option, which is the most appropriate to their planned future career. Followings are the program's details:

Degree Completion Requirement

To become eligible for award of BS degree, a student must satisfy the following requirements:

- a) Minimum credit hours shall be **133** for BS Computer Science program including elective courses & a Capstone Project.
- b) Must have earned **CGPA** (Cumulative Grade Point Average) **of at least 2.0 on a scale of 4.0**.

Duration

The program shall comprise of minimum 4 and up to a maximum of 6 years as per rules of the University.

Eligibility Criteria

From Fall 2022, for BS (CS) the following eligibility admission criteria will be followed.

- The minimum requirements for admission in a bachelor's degree program in Computer Science is at least 50% marks in Intermediate (HSSC) examination with Mathematics or equivalent qualification with Mathematics certified by IBCC.
- The three years' diploma (DAE) with 50% marks in any technology duly recognized by Pakistan Board of Technical Education (PBTE) having Mathematics 150 marks are eligible.
- The applicants having F.Sc. Pre-Medical or equivalent qualification without mathematics shall cover two deficiency courses of Pre-Calculus-I and Pre-Calculus-II in first year of their degree program.

**Proposed Distribution of Courses
(Regular Track)**

| Semester 1 (18 Cr. Hrs.) | Semester 2 (19 Cr. Hrs.) | Semester 3 (17 Cr. Hrs.) | Semester 4 (19 Cr. Hrs.) | Semester 5 (18 Cr. Hrs.) | Semester 6 (18 Cr. Hrs.) | Semester 7 (15 Cr. Hrs.) | Semester 8 (09 Cr. Hrs.) |
|---|---|---|---|---|--|--|---|
| CSC-112 4(3-1) Programming Fundamentals | CSC-121 4(3-1) Object Oriented Programming | CSC-231 4(3-1) Data Structures & Algorithms | CSC-241 4(3-1) Operating Systems | CSC-351 3(3-0) Design & Analysis of Algorithms | CSC-361 3(3-0) Theory of Automata | CSC-471 3(3-0) Compiler Construction | CSC-481 3(0-3) Final Year Project-II |
| MTH-1XX 3(3-0) Calculus & Analytical Geometry | MTH-1XX 3(3-0) Multivariate Calculus | CSC-233 3(3-0) Discrete Structures | MTH-XXX 3(3-0) Linear Algebra | MTH-XXX 3(3-0) Differential Equations | XXX-XXX 3(3-0) University Elective – III | CSC-473 3(0-3) Final Year Project-I | CSC-483 3(3-0) CS Supporting Course (Numerical Computing) |
| PHY-113 3(3-0) Applied Physics | CSC-122 4(3-1) Digital Logic Design | CSC-232 4(3-1) Computer Organization & Assembly Language | CSC-242 4(3-1) Database Systems | CSC-354 3(3-0) CS Elective – I (General Elective) Mobile Application Development | CSC-362 3(3-0) CS Elective – III (Web Engineering) | CSC-474 3(3-0) CS Elective – V (OOAD) | CSC-482 3(3-0) Professional Practices |

| | | | | | | |
|--|---|--|--|---|---|---|
| ENG-1XX 3(3-0) Introduction to Grammar | ENG-1XX 3(3-0) English Language Skills | CSC-234 3(3-0) Software Engineering | CSC-243 4(3-1) Computer Networks | CSC-352 3(3-0) Parallel & Distributed Computing | ENG-XXX 3(3-0) Technical & Business Writing | CSC-47X 3(3-0) CS Elective – VI (D1/D2) |
| ISL-1XX 2(2-0) Islamic Studies/ Ethics | PKS-1XX 2(2-0) Pakistan Studies | XXX-XXX 3(3-0) University Elective – I | CSC-244 4(3-1) Artificial Intelligence | CSC-35X 3(3-0) CS Elective – II (D1/D2) | CSC-36X 3(3-0) CS Elective – IV (D1/D2) | CSC-472 3(3-0) Information Security |
| CSC-111 3(2-1) Introduction to ICT | STS-1XX 3(3-0) Probability and Statistics | | | XXX-XXX 3(3-0) University Elective - II | XXX-XXX 3(3-0) University Elective – IV | |

D1: AI Domain

D2: Networks Domain

Institute in Electrical/Electronics/IT/Computer Hardware/Telecom/Commerce duly recognized from Pakistan Board of Technical Education (PBTE). However, diploma holders can only apply against reserved seats as per university admission policy.

Assessment & Evaluation

University's semester and examination rules & regulations shall be followed for assessment & evaluation.

Distribution of Courses

Followings are the distribution of total credit hours.

| Course Group | Credit hours | % age |
|-------------------|--------------|-------|
| General Education | 19 | 14.2% |

| | | |
|----------------------------------|------------|--------------|
| University Electives | 12 | 9% |
| Mathematics & Science Foundation | 12 | 9% |
| Computing – Core | 39 | 29.3% |
| Common courses Total | 82 | 61.7% |
| Domain CS Core | 24 | 18% |
| Domain CS Electives | 18 | 13.5% |
| Domain CS Supporting | 9 | 6.7% |
| Domain courses Total | 51 | 38.3% |
| TOTAL | 133 | 100% |

Courses common for all computing BS programs – 82 Credits
Computing Core Courses

| Course Code | Course Title | Credit hours |
|--------------------|------------------------------|---------------------|
| CSC-112 | Programming Fundamentals | 4(3-1) |
| CSC-121 | Object Oriented Programming | 4(3-1) |
| CSC-231 | Data Structures & Algorithms | 4(3-1) |
| CSC-233 | Discrete Structures | 3(3-0) |
| CSC-241 | Operating Systems | 4(3-1) |
| CSC-242 | Database Systems | 4(3-1) |
| CSC-234 | Software Engineering | 3(3-0) |
| CSC-243 | Computer Networks | 4(3-1) |
| CSC-472 | Information Security | 3(3-0) |
| CSC-473 | Final Year Project I | 3(0-3) |
| CSC-481 | Final Year Project II | 3(0-3) |
| | Total | 39 (27-12) |

General Education Courses

| Course Code | Course Title | Credit hours |
|--------------|--|------------------|
| ENG-XXX | Introduction to Grammar | 3(3-0) |
| ENG-XXX | Technical & Business Writing | 3(3-0) |
| ENG-XXX | English Language Skills | 3(3-0) |
| CSC-482 | Professional Practices | 3(3-0) |
| CSC-111 | Introduction to Information & Communication Technologies | 3(2-1) |
| PKS-XXX | Pakistan Studies | 2 |
| ISL-XXX | Islamic Studies/ Ethics | 2 |
| Total | | 19 (18-1) |

University Elective Courses

(Not limited to the list below, university may add more courses)

| Course Title | Credit hours |
|------------------------------|--------------|
| Foreign Language | 3(3-0) |
| Chinese Language | 3(3-0) |
| Arabic Language | 3(3-0) |
| Psychology | 3(3-0) |
| Social Service | 3(3-0) |
| Management Related | 3(3-0) |
| Principles of Management | 3(3-0) |
| Human Resource Management | 3(3-0) |
| Economics | 3(3-0) |
| Accounting and Finance | 3(3-0) |
| Organizational Behavior | 3(3-0) |
| Intellectual Property Rights | 3(3-0) |
| Social Science Related | 3(3-0) |
| Social Work | 3(3-0) |
| Sociology | 3(3-0) |
| Economy Related | 3(3-0) |
| Bioinformatics | 3(3-0) |

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|--------------------|------------------|
| English Literature | 3(3-0) |
| Graphics & Arts | 3(3-0) |
| Total | 12 (12-0) |

Mathematics and Science Foundation Courses

| Course Code | Course Title | Credit hours |
|--------------------|--------------------------------|---------------------|
| XXX-XXX | Precalculus I | Zero Credit |
| XXX-XXX | Precalculus II | Zero Credit |
| MTH-XXX | Calculus & Analytical Geometry | 3(3-0) |
| STS-XXX | Probability & Statistics | 3(3-0) |
| MTH-XXX | Linear Algebra | 3(3-0) |
| PHY-113 | Applied Physics | 3(3-0) |
| | Total | 12 (12-0) |

Domain Courses for BS (COMPUTER SCIENCE) Computer Science CORE (Compulsory) courses

| Course Code | Course Title | Credit hours |
|--------------------|--|---------------------|
| CSC-471 | Compiler Construction | 3(3-0) |
| CSC-232 | Comp. Organization & Assembly Language | 4(3-1) |
| CSC-122 | Digital Logic Design | 4(3-1) |
| CSC-351 | Design & Analysis of Algorithms | 3(3-0) |
| CSC-352 | Parallel & Distributed Computing | 3(3-0) |
| CSC-244 | Artificial Intelligence | 4(3-1) |
| CSC-361 | Theory of Automata | 3(3-0) |
| | Total | 24 (21-3) |

Computer Science SUPPORTING courses (ANY 3 from following list)

Coverage of relevant pre-requisite must be ensured while offering any of the following courses from this category

| Course Code | Course Title | Credit hours |
|--------------------|---------------------------------------|---------------------|
| MTH-XXX | Differential Equations | 3-0 |
| MTH-XXX | Multi-variate Calculus | 3-0 |
| MTH-XXX | Graph Theory | 3-0 |
| CSC-483 | Numerical Computing | 3-0 |
| | Total (Any three of the above) | 12-0 |

Computer Science ELECTIVE courses for General CS, AI, and Networks Stream

| Course Title | Credit hours |
|---------------------|---------------------|
| CS Elective – 1 | 3 |
| CS Elective – 2 | 3 |
| CS Elective – 3 | 3 |
| CS Elective – 4 | 3 |
| CS Elective – 5 | 3 |
| CS Elective – 6 | 3 |
| Total | 18 |

List of General CS Elective Courses

| Computer Science Electives | | | |
|-----------------------------------|--------------------|-----------------------------------|---------------------|
| S. No. | Course Code | Course Title | Credit hours |
| 1. | CSC-353 | Human Computer Interaction | 3-0 |
| 2. | CSC-354 | Mobile Application Development | 3-0 |
| 3. | CSC-362 | Web Engineering | 3-0 |
| 4. | CSC-474 | Object-oriented Analysis & Design | 3-0 |
| 5. | CSC-475 | Modern Programming Languages | 3-0 |
| 6. | CSC-368 | Software Packages | 3-0 |
| 7. | CSC-116 | Introduction to Computing | 3-0 |

| | | | |
|-----|---------|--------------------------------------|-----|
| 8. | CSC-XXX | Web System & Technology | 3-0 |
| 9. | CSC-XXX | Theory of Programming Language | 3-0 |
| 10. | CSC-XXX | Advanced Database Systems | 3-0 |
| 11. | CSC-XXX | Formal Methods | 3-0 |
| 12. | CSC-XXX | Logical Paradigms of Computing | 3-0 |
| 13. | CSC-XXX | Game Development | 3-0 |
| 14. | CSC-XXX | Fundamentals of Data Mining | 3-0 |
| 15. | CSC-XXX | Data Warehousing | 3-0 |
| 16. | CSC-XXX | Web Design & Development | 3-0 |
| 17. | CSC-XXX | Search Engine Optimization | 3-0 |
| 18. | CSC-XXX | System Programming | 3-0 |
| 19. | CSC-XXX | Visual Programming | 3-0 |
| 20. | CSC-XXX | Computer Graphics | 3-0 |
| 21. | CSC-XXX | Database Administration & Management | 3-0 |
| 22. | CSC-XXX | Cyber Security | 3-0 |
| 23. | CSC-XXX | Agent-based Software Engineering | 3-0 |
| 24. | CSC-XXX | Big Data Analytics | 3-0 |
| 25. | CSC-XXX | Cloud Computing | 3-0 |
| 26. | CSC-XXX | Data Encryption and Security | 3-0 |
| 27. | CSC-XXX | E-Commerce | 3-0 |
| 28. | CSC-XXX | Global Software Development | 3-0 |
| 29. | CSC-XXX | Information Systems Audit | 3-0 |
| 30. | CSC-XXX | Management Information Systems | 3-0 |
| 31. | CSC-XXX | Multimedia Communication | 3-0 |
| 32. | CSC-XXX | Real Time Systems | 3-0 |
| 33. | CSC-XXX | Semantic Web | 3-0 |
| 34. | CSC-XXX | Software Engineering Economics | 3-0 |
| 35. | CSC-XXX | Software Metrics | 3-0 |
| 36. | CSC-XXX | Systems Programming | 3-0 |
| 37. | CSC-XXX | Topics in Software Engineering | 3-0 |

List of Elective Courses in AI Domain

| Computer Science Electives (AI Domain) | | | |
|---|--------------------|-----------------------------|---------------------|
| S. No. | Course Code | Course Title | Credit hours |
| 1. | CSC-355 | Computer Vision | 3-0 |
| 2. | CSC-356 | Digital Image Processing | 3-0 |
| 3. | CSC-476 | Fuzzy Logic Systems | 3-0 |
| 4. | CSC-477 | Computational Intelligence | 3-0 |
| 5. | CSC-357 | Natural Language Processing | 3-0 |
| 6. | CSC-363 | Deep Learning | 3-0 |
| 7. | CSC-364 | Machine Learning | 3-0 |
| 8. | CSC-365 | Data Analytics | 3-0 |
| 9. | CSC-XXX | Expert Systems | 3-0 |
| 10. | CSC-XXX | Artificial Neural Networks | 3-0 |

List of Elective Courses in Networks Domain

| Computer Science Electives (Networks Domain) | | | |
|---|--------------------|-----------------------|---------------------|
| S. No. | Course Code | Course Title | Credit hours |
| 1. | CSC-366 | Internet of Things | 3-0 |
| 2. | CSC-479 | Sensor Networks | 3-0 |
| 3. | CSC-478 | Wireless Networking | 3-0 |
| 4. | CSC-358 | Networking Strategies | 3-0 |
| 5. | CSC-359 | Network Optimization | 3-0 |
| 6. | CSC-XXX | Network Security | 3-0 |

Proposed Study Plan for BS (Computer Science) Semester Wise

Course Codes have been assigned considering codes generated by Kohsar University, Murree. Moreover, courses marked with XX needs to be generated. The purpose is to indicate pre-requisite courses for studying advanced courses those shall be generated after the approval of Academic Council.

Semester - I

| Code | Course Title | Credit Hours | Pre-requisite |
|--------------|---|-----------------|---------------|
| CSC-111 | Introduction to Information and Communication Technologies | 3(2-1) | |
| CSC-112 | Programming Fundamentals | 4(3-1) | |
| ENG-1XX | English Composition & Comprehension / Introduction to Grammar | 3(3-0) | |
| MTH-1XX | Calculus & Analytical Geometry | 3(3-0) | |
| ISL-1XX | Islamic Studies/ Ethics | 2(2-0) | |
| PHY-113 | Applied Physics | 3(3-0) | |
| Total | | 18(16-2) | |

Semester – II

| Code | Course Title | Credit Hours | Pre-requisite |
|--------------|---|---------------------|--|
| CSC-122 | Digital Logic Design | 4(3-1) | PHY-113 Applied Physics |
| CSC-121 | Object Oriented Programming | 4(3-1) | CSC-112 Programming Fundamentals |
| ENG-1XX | Communication & Presentation Skills / English Language Skills | 3(3-0) | ENG-1XX English Composition & Comprehension / ENG-1XX Introduction to English Grammar |
| MTH-1XX | Multivariate Calculus | 3(3-0) | MTH-1XX Calculus & Analytical Geometry |
| STS-1XX | Probability and Statistics | 3(3-0) | |
| PKS-1XX | Pakistan Studies | 2(2-0) | |
| Total | | 19(17-2) | |

Semester – III

| Code | Course Title | Credit Hours | Pre-requisite |
|--------------|---|---------------------|-------------------------------------|
| CSC-231 | Data Structures & Algorithms | 4(3-1) | CSC-121 Object Oriented Programming |
| CSC-232 | Computer Organization & Assembly Language | 4(3-1) | |
| CSC-233 | Discrete Structures | 3(3-0) | |
| CSC-234 | Software Engineering | 3(3-0) | |
| UE-XXX | University Elective-I | 3(3-0) | |
| Total | | 18(15-3) | |

Semester – IV

| Code | Course Title | Credit Hours | Pre-requisite |
|--------------|-------------------------|---------------------|--------------------------------------|
| CSC-241 | Operating Systems | 4(3-1) | CSC-231 Data Structures & Algorithms |
| CSC-242 | Database Systems | 4(3-1) | CSC-231 Data Structures & Algorithms |
| CSC-243 | Computer Networks | 4(3-1) | |
| MTH-3XX | Linear Algebra | 3(3-0) | |
| CSC-244 | Artificial Intelligence | 3(3-0) | CSC-233 Discrete Structures |
| Total | | 18(15-3) | |

Semester – V

| Code | Course Title | Credit Hours | Pre-requisite |
|--------------|---|---------------------|--------------------------------------|
| XXX-XXX | University Elective - II | 3(3-0) | |
| CSC-351 | Design & Analysis of Algorithms | 3(3-0) | CSC-231 Data Structures & Algorithms |
| MTH-XXX | Differential Equations | 3(3-0) | |
| CSC-354 | CS Elective – I (General Elective) Mobile Application Development | 3(3-0) | |
| CSC-35X | CS Elective – II (D1/D2) | 3(3-0) | |
| CSC-352 | Parallel & Distributed Computing | 3(3-0) | CSC-241 Operating Systems |
| Total | | 18(18-0) | |

Semester – VI

| Code | Course Title | Credit Hours | Pre-requisite |
|--------------|---|---------------------|----------------------|
| XXX-XXX | University Elective – III | 3(3-0) | |
| CSC-361 | Theory of Automata | 3(3-0) | |
| ENG-3XX | Technical & Business Writing | 3(3-0) | |
| XXX-XXX | University Elective – IV | 3(3-0) | |
| CSC-362 | CS Elective – III (Web System & Technologies) | 3(3-0) | |
| CSC-36X | CS Elective – IV (D1/D2) | 3(3-0) | |
| Total | | 18(18-0) | |

Semester – VII

| Code | Course Title | Credit Hours | Pre-requisite |
|--------------|---|---------------------|----------------------------|
| CSC-471 | Compiler Construction | 3(3-0) | CSC-361 Theory of Automata |
| CSC-472 | Information Security | 3(3-0) | |
| CSC-474 | CS Elective - V (Object-oriented Analysis & Design) | 3(3-0) | |
| CSC-47X | CS Elective – VI (D1/D2) | 3(3-0) | |
| CSC-473 | Final Year Project-I | 3(0-3) | |
| Total | | 15(12-3) | |

Semester – VIII

| Code | Course Title | Credit Hours | Pre-requisite |
|--------------|--|---------------------|----------------------|
| CSC-482 | Professional Practices | 3(3-0) | |
| CSC-483 | CS Supporting Course (Numerical Computing) | 3(3-0) | |
| CSC-481 | Final Year Project-II | 3(0-3) | CSC-473 FYP-I |
| Total | | 9(6-3) | |
