

DEPARTMENT OF SOFTWARE ENGINEERING

The focus of BS software engineering program is to train the students to apply the software engineering principles by demonstrating competence in communication, planning, analysis, design, construction, testing and development of software systems. Our software engineering program places a great emphasis on hands-on training along with theory classes, the students learn the current tools and technologies used in

software industry. In addition to the technical skills and knowledge, the program also focuses on ethical and societal aspects through courses on humanities, personal grooming, and professional ethics. After successful completion of BS software engineering degree, the students can assume the role of software engineer, designer, developer or tester in any reputable organization.



BS Software Engineering

■ Program Educational Objectives (PEOs)

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

- (i) Contribute competently in the software industry by applying requisite technical skills.
- (ii) Demonstrate advancement in software engineering 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(SE) program will possess the following attributes

- (i) **Academic Education:** To prepare graduates as computing professionals.
- (ii) **Knowledge for Solving Computing Problems:** Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the 16 abstraction and conceptualization of computing models from defined problems and requirements .
- (iii) **Problem Analysis:** Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

- (iv) **Design/ Development of Solutions:** Design and evaluate solutions for complex computing 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.
- (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 an individual and as a member or leader in diverse teams and in multidisciplinary settings.
- (vii) **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.
- (viii) **Computing 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 computing practice.
- (ix) **Ethics:** Understand and commit to professional ethics, responsibilities, and norms of professional computing practice.
- (x) **Life-long 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 Software Engineering degree is required to successfully earn 133 credit hours as per the following detail:

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

■ General Education (30 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Functional English	SEG1113	3
Expository Writing	SEG1123	3
Islamic Studies/Ethics	SEG1012	2
Ideology and Constitution of Pakistan	SEG1022	2
Personal Grooming	SEG2212	2
Applied Physics	SEG1312	2
Applied Physics Lab	SEG1311	1
Sociology	SEG1412	2
Calculus and Analytical Geometry	SEG1513	3
Discrete Structures	SEG1573	3
Applications of Information and Communication Technologies	SEG1612	2

Applications of Information and Communication Technologies Lab	SEG1611	1
Entrepreneurship	SEG2712	2
Civics and Professional Ethics	SEG2812	2

■ Major Courses (73 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Introduction to Programming	SE1133	3
Introduction to Programming Lab	SE1131	1
Object Oriented Programming	SE1143	3
Object Oriented Programming Lab	SE1141	1
Data Structures	SE2143	3
Data Structures Lab	SE2141	1
Database Systems	SE2313	3
Database Systems Lab	SE2311	1
Software Engineering	SE2223	3
Operating Systems	SE2412	2
Operating Systems Lab	SE2411	1
Computer Networks	SE2772	2
Computer Networks Lab	SE2771	1
Software Requirement Engineering	SE2262	2
Software Requirement Engineering Lab	SE2261	1
Information Security	SE3712	2
Information Security Lab	SE3711	1
Software Design and Architecture	SE3313	3
Analysis of Algorithms	SE3163	3
Digital Logic Design	SE2512	2
Digital Logic Design Lab	SE2511	1
Computer Organization and Assembly Language	SE3522	2
Computer Organization and Assembly Language Lab	SE3521	1
Artificial Intelligence	SE3812	2
Artificial intelligence Lab	SE3811	1

Parallel and Distributed Computing	SE3432	2
Parallel and Distributed Computing Lab	SE3431	1
HCI and Computer Graphics	SE3272	2
HCI and Computer Graphics Lab	SE3271	1
Software Quality Engineering	SE3612	2
Software Quality Engineering Lab	SE3611	1
Software Construction & Development	SE3512	2
Software Construction & Development Lab	SE3511	1
Web Engineering	SE3522	2
Web Engineering Lab	SE3521	1
Software Project Management	SE4272	2
Software Project Management Lab	SE4271	1
Data Science	SE4882	2
Data Science Lab	SE4881	1
Financial Accounting	ACSE4003	3
Mobile Application Development	SE4192	2
Mobile Application Development Lab	SE4191	1

■ Allied Courses (12 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Linear Algebra	MTSE1033	3
Probability and Statistics	MTSE2063	3
Multivariable Calculus	MTSE2053	3
Technical and Business Writing	HMSE4033	3

■ Electives Courses (9 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Elective-I (Automated Software Testing)	SE3343	3
Elective-II (Internet of Things)	SE4743	3
Elective-III (Blockchain Technology)	SE4573	3

■ Capstone Project (6 Cr. Hrs.)

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

Course Title	Code	Cr. Hrs.
Design Project Part-I	SE4912	2
Design Project Part-II	SE4924	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	SE4103	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-year degree program comprising of 8 semesters with minimum of 133 semester credit hours (Cr. Hrs). There will be a Fall and a Spring semester in each year. The Summer semester will be utilized for internships or deficiency courses. The maximum duration to complete BS is 7 years.

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

SCHEME OF STUDIES

BS Software Engineering

□ Semester-I (18 Cr. Hrs.)

Course Code	Course Title	Cr. Hrs.
SE1133	Introduction to Programming	3
SE1131	Introduction to Programming Lab	1
SEG1612	Applications of Information and Communication Technologies	2
SEG1611	Applications of Information and Communication Technologies Lab	1
SEG1312	Applied Physics	2
SEG1311	Applied Physics Lab	1
SEG1513	Calculus and Analytical Geometry	3
SEG1022	Ideology and Constitution of Pakistan	2
SEG1113	Functional English	3

□ Semester-II (17 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
SE1143	Object Oriented Programming	3
SE1141	Object Oriented Programming Lab	1
SEG1573	Discrete Structures	3
SEG1123	Expository writing	3
MTSE1033	Linear Algebra	3
SEG1012	Islamic Studies/Ethics	2
SEG1412	Sociology	2

□ Semester-III (18 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
SE2143	Data Structures	3
SE2141	Data Structures Lab	1
SE2313	Database Systems	3
SE2311	Database Systems Lab	1

SE2223	Software Engineering	3
SEG2212	Personal Grooming	2
SEG2712	Entrepreneurship	2
MTSE2063	Probability and Statistics	3

□ Semester-IV (17 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
SEG2812	Civics and Professional Ethics	2
SE2512	Digital Logic Design	2
SE2511	Digital Logic Design Lab	1
SE2412	Operating Systems	2
SE2411	Operating Systems Lab	1
SE2772	Computer Networks	2
SE2771	Computer Networks Lab	1
SE2262	Software Requirement Engineering	2
SE2261	Software Requirement Engineering Lab	1
MTSE2053	Multivariable Calculus	3

□ Semester-V (18 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
SE3712	Information Security	2
SE3711	Information Security Lab	1
SE3313	Software Design and Architecture	3
SE3163	Analysis of Algorithms	3
SE3522	Computer Organization and Assembly Language	2
SE3521	Computer Organization and Assembly Language Lab	1
SE3432	Parallel and Distributed Computing	2
SE3431	Parallel and Distributed Computing Lab	1
SE3272	HCI and Computer Graphics	2
SE3271	HCI and Computer Graphics Lab	1

□ Semester-VI (15 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
SE3612	Software Quality Engineering	2
SE3611	Software Quality Engineering Lab	1
SE3512	Software Construction & Development	2
SE3511	Software Construction & Development Lab	1
SE3522	Web Engineering	2
SE3521	Web Engineering Lab	1
SE3343	Elective-I (Automated Software Testing)	3
SE3812	Artificial Intelligence	2
SE3811	Artificial Intelligence Lab	1

□ Semester-VII (17 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
SE4272	Software Project Management	2
SE4271	Software Project Management Lab	1
SE4882	Data Science	2
SE4881	Data Science Lab	1
HMSE4033	Technical & Business Writing	3
SE4912	Design Project-I	2
SE4743	Elective-II (Internet of Things)	3
SE4192	Mobile Application Development	2
SE4191	Mobile Application Development Lab	1

□ Semester-VIII (10 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
SE4573	Elective-III (Blockchain Technology)	3
ACSE4003	Financial Accounting	3
SE4924	Design Project Part -II	4



BS Artificial Intelligence

■ Program Educational Objectives (PEOs)

The BS(AI) 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 in Artificial Intelligence.
- (iii) Demonstrate ethical values and contribute positively towards the society.

■ Program Learning Outcomes (PLOs)

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

- (i) **Academic Education:** To prepare graduates as computing professionals.
- (ii) **Knowledge for Solving Computing Problems:** Apply knowledge of computing fundamentals, knowledge of a computing specialization, and mathematics, science, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.
- (iii) **Problem Analysis:** Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

- (iv) **Design/Development of Solutions:** Design and evaluate solutions for complex computing 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.
- (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 an individual and as a member or leader in diverse teams and in multi-disciplinary settings.
- (vii) **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.
- (viii) **Computing 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 computing practice.
- (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 Artificial Intelligence (AI) 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 Courses (30 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Functional English	AIG1113	3
Expository Writing	AIG1123	3
Islamic Studies/Ethics	AIG1012	2
Ideology and Constitution of Pakistan	AIG1022	2
Personal Grooming	AIG2212	2
Applied Physics	AIG1312	2
Applied Physics Lab	AIG1311	1
Sociology	AIG1412	2
Calculus and Analytical Geometry	AIG1513	3
Discrete Structures	AIG1573	3
Applications of Information and Communication Technologies	AIG1612	2

Applications of Information and Communication Technologies Lab	AI61611	1
Entrepreneurship	AI62712	2
Civics and Professional Ethics	AI62812	2

■ Major Courses (73 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Introduction to Programming	AI1133	3
Introduction to Programming Lab	AI1131	1
Object Oriented Programming	AI1143	3
Object Oriented Programming Lab	AI1141	1
Database Systems	AI2313	3
Database Systems Lab	AI2311	1
Digital Logic Design	AI2512	2
Digital Logic Design Lab	AI2511	1
Data Structures	AI2143	3
Data Structures Lab	AI2141	1
Information Security	AI3712	2
Information Security Lab	AI3711	1
Artificial Intelligence	AI2812	2
Artificial Intelligence Lab	AI2811	1
Computer Networks	AI2772	2
Computer Networks Lab	AI2771	1
Software Engineering	AI3223	3
Computer Organization & Assembly Language	AI3522	2
Computer Organization & Assembly Language Lab	AI3521	1
Operating Systems	AI2412	2
Operating Systems Lab	AI2411	1
Analysis of Algorithms	AI3163	3
Programming for Artificial Intelligence	AI2822	2
Programming for Artificial Intelligence Lab	AI2821	1
Machine Learning	AI3812	2
Machine Learning Lab	AI3811	1
Artificial Neural Networks & Deep Learning	AI3842	2

Artificial Neural Networks & Deep Learning Lab	AI3841	1
Knowledge Representation and Reasoning	AI3312	2
Knowledge Representation and Reasoning Lab	AI3311	1
Computer Vision	AI3832	2
Computer Vision Lab	AI3831	1
Parallel & Distributed Computing	AI3432	2
Parallel & Distributed Computing Lab	AI3431	1
Data Mining	AI4322	2
Data Mining Lab	AI4321	1
Advanced Statistics	AI3072	2
Advanced Statistics Lab	AI3071	1
HCI and Computer Graphics	AI4272	2
HCI and Computer Graphics Lab	AI4271	1
Swarm Intelligence	AI4812	2
Swarm Intelligence Lab	AI4811	1
Financial Accounting	ACAI3003	3

■ Allied Courses (12 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Multivariable Calculus	MTAI2053	3
Linear Algebra	MTAI1033	3
Probability & Statistics	MTAI2063	3
Technical & Business Writing	HMAI4033	3

■ Elective Courses (09 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Elective-I (Natural Language Processing)	AI4822	2
Elective-I (Natural Language Processing Lab)	AI4821	1
Elective-II (Speech Processing)	AI4882	2
Elective-II (Speech Processing Lab)	AI4881	1
Elective-III (Reinforcement Learning)	AI4852	2
Elective-III (Reinforcement Learning Lab)	AI4851	1

■ Capstone Project (6 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 below:

Course Title	Code	Cr. Hrs.
Final Year Project-I	AI4912	2
Final Year Project-II	AI4924	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	AI4103	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 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 Artificial Intelligence

□ Semester-I (18 Cr. Hrs.)

Course Code	Course Title	Cr. Hrs.
AI1133	Introduction to Programming	3
AI1131	Introduction to Programming Lab	1
AIG1612	Applications of Information and Communication Technologies	2
AIG1611	Applications of Information and Communication Technologies Lab	1
AIG1312	Applied Physics	2
AIG1311	Applied Physics Lab	1
AIG1513	Calculus and Analytical Geometry	3
AIG1113	Functional English	3
AIG1022	Ideology and Constitution of Pakistan	2

□ Semester-II (17 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
AI1143	Object Oriented Programming	3
AI1141	Object Oriented Programming Lab	1
AIG1012	Islamic Studies/Ethics	2
AIG1573	Discrete Structures	3
AIG1123	Expository Writing	3
MTAI1033	Linear Algebra	3
AIG1412	Sociology	2

□ Semester-III (18 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
AI2143	Data Structures	3
AI2141	Data Structures Lab	1
AI2313	Database Systems	3
AI2311	Database System Lab	1
AI2812	Artificial Intelligence	2

AI2811	Artificial Intelligence Lab	1
MTAI2063	Probability and Statistics	3
AIG2212	Personal Grooming	2
AIG2712	Entrepreneurship	2

□ Semester-IV (17 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
AI2412	Operating Systems	2
AI2411	Operating Systems Lab	1
AI2512	Digital Logic Design	2
AI2511	Digital Logic Design Lab	1
AI2772	Computer Networks	2
AI2771	Computer Networks Lab	1
AI2822	Programming for AI	2
AI2821	Programming for AI Lab	1
AIG2812	Civics and Professional Ethics	2
MTAI2053	Multivariable Calculus	3

□ Semester-V (18 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
AI3712	Information Security	2
AI3711	Information Security Lab	1
AI3163	Analysis of Algorithms	3
AI3522	Computer Organization & Assembly Language	2
AI3521	Computer Organization & Assembly Language Lab	1
AI3812	Machine Learning	2
AI3811	Machine Learning Lab	1
AI3432	Parallel and Distributed Computing	2
AI3431	Parallel and Distributed Computing Lab	1
AI3223	Software Engineering	3

□ Semester-VI (15 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
AI3842	Artificial Neural Networks & Deep Learning	2
AI3841	Artificial Neural Networks & Deep Learning Lab	1
AI3832	Computer Vision	2
AI3831	Computer Vision Lab	1
AI3312	Knowledge Representation and Reasoning	2
AI3311	Knowledge Representation and Reasoning Lab	1
AI3072	Advanced Statistics	2
AI3071	Advanced Statistics Lab	1
ACAI3003	Financial Accounting	3

□ Semester-VII (17 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
AI4272	HCI and Computer Graphics	2
AI4271	HCI and Computer Graphics Lab	1
AI4322	Data Mining	2
AI4321	Data Mining Lab	1
AI4822	Elective-I (Natural Language Processing)	2
AI4821	Elective-I (Natural Language Processing Lab)	1
AI4882	Elective-II (Speech Processing)	2
AI4881	Elective-II (Speech Processing Lab)	1
HMAI4033	Technical & Business Writing	3
AI4912	Final Year Project-I	2

□ Semester-VIII (10 Cr. Hrs)

Course Code	Course Title	Cr. Hrs.
AI4812	Swarm Intelligence	2
AI4811	Swarm Intelligence Lab	1
AI4852	Elective-III (Reinforcement Learning)	2
AI4851	Elective-III (Reinforcement Learning Lab)	1
AI4924	Final Year Project-II	4

Master of Artificial Intelligence

■ Admission Requirements

- (i) A minimum of 16 years of education leading to BS in Artificial Intelligence / Data Science / Computer Science / Information Technology / Software Engineering / Mathematics or equivalent recognized by HEC
- (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)

Area	Cr. Hrs.
a) Core Courses	12
b) Elective Courses (with / without thesis)	12/18
c) Research Thesis	06
Total	30

■ Core Courses (12 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Advanced Machine Learning	AI5813	3
Applied Artificial Intelligence	AI5823	3
Advanced Analysis of Algorithms	AI5833	3
Mathematics for Artificial Intelligence	AI5843	3

■ Elective Courses (12 Credit Hours)

Course Title	Code	Cr. Hrs.
Data Mining	AI58x3	3
Information Retrieval	AI68x3	3
Applied Natural Language Processing	AI68x3	3
Heuristic Methods for Optimization	AI68x3	3
Pattern Recognition	AI68x3	3

Fuzzy Systems	AI68x3	3
Deep Learning	AI68x3	3
Advanced Computer Vision	AI68x3	3
Applied Neural Networks	AI68x3	3
Multi-Agent Systems	AI68x3	3

■ CGPA Requirement

A student is required to earn a minimum of 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 30 semester credit hours. There will be a fall and a spring Semester in each year. The Maximum duration to complete MS in Artificial Intelligence is 4 years.

