BS Software Engineering

The Department of Computer Science offers a 4-year BS Software Engineering (BSSE) program that follows the latest HEC and NCEAC-approved curriculum, focusing on best practices, methodologies, and processes for developing high-quality, reliable software. The curriculum provides students with both essential theoretical knowledge and the practical skills needed to thrive as software engineering professionals.

In addition to classroom learning, the program emphasizes practical experience, enabling students to analyze and solve real-world problems. To further enhance their skills, students are encouraged to participate in internships, where they apply their knowledge to real-world software design and analysis.

BSSE graduates are well-prepared for careers in the software industry, taking on roles such as full-stack developers, system analysts, product designers, project managers, and quality assurance specialists.

The department has already secured accreditation for the Fall 2020 batch of the BS Software Engineering program, and the accreditation process for other batches is currently in progress.

Program Mission for BS Software Engineering (SE)

The mission of the Bachelor of Software Engineering (SE) program is to provide a high-quality education that equips students with both technical expertise and essential transferable skills. The program aims to cultivate graduates who are proficient in Software engineering, demonstrate social and ethical responsibility, and are committed to ongoing professional development and career advancement.

Program Educational Objectives (PEOs) for BSSE

Program Educational Objectives (PEOs) are the attributes and abilities that the graduates are expected to demonstrate within a few years after graduation. The PEOs are a direct translation of program mission and are derived involving all stakeholders aligned with University and Institute missions. Department of Computer Science has defined and established its PEOs keeping in view the desirable attributes of our graduates.

The Program Educational Objectives (PEOs) are focused on to produce BS Software Engineering graduates who are:

PEO 1: Produce graduates who are competent and knowledgeable software engineers capable of applying sound engineering principles, design patterns, and software development methodologies to create robust and efficient software systems.

PEO 2: Develop graduates with strong communication, teamwork, and ethical reasoning abilities to collaborate effectively in software development projects and address societal implications of software systems.

PEO 3: Foster graduates who are lifelong learners, capable of adapting to the evolving software engineering landscape through continuous learning and professional development, and contribute to the advancement of software engineering practices.

3.3 Graduate Attributes (GAs) for BSSE

The Graduate Attributes (GA) are statements that describe the set of skills, knowledge, and attitude that university expects from its graduates. The GAs broadly describes the

knowledge, skills, and behaviors the students acquire in their program of study that is intended to foster the achievement of Program Educational Objectives (PEOs). The following GAs for undergraduate computing programs has been adopted from the Seol Accord as recommended by the National Computing Education Accreditation Council (NCEAC). By the time of graduation, the program enables students to:

1. **Academic Education:** Completion of an accredited software engineering program designed to prepare graduates as software engineering professionals.
2. **Knowledge for Solving Computing Problems:** Apply knowledge of software engineering fundamentals, software design patterns, algorithms, and relevant domain knowledge to solve real-world software engineering problems.
3. **Problem Analysis:** Identify, formulate, research, and solve complex software engineering problems reaching substantiated conclusions using fundamental principles of software engineering, mathematics, and relevant domain disciplines.
4. **Design/Development of Solutions:** Design, develop, test, and evaluate software solutions for complex problems, considering software quality, usability, and maintainability.
5. **Modern Tool Usage:** Create, select, adapt, and apply appropriate software development tools, methodologies, and technologies to complex software engineering activities.
6. **Individual and Team Work:** Function effectively as an individual and as a member or leader in diverse software development teams.
7. **Communication:** Communicate effectively with the software engineering community and with society at large about complex software engineering projects and systems.
8. **Computing Professionalism and Society:** Understand and assess societal, legal, and ethical issues related to software development and the consequential responsibilities of software engineers.
9. **Ethics:** Understand and commit to professional ethics, responsibilities, and norms of software engineering practice.
10. **Lifelong Learning:** Recognize the need, and have the ability, to engage in independent learning for continual development as a software engineering professional.

Mapping of PEOs to GAs

S.No.	Graduate Attributes (GAs)	Program Education Objectives (PEOs)		
		PEO-1	PEO-2	PEO-3
1.	Academic Education	✓		
2.	Knowledge for Solving Computing Problems	✓		
3.	Problem Analysis	✓		
4.	Design/ development of Solutions	✓		
5.	Modern Tool Usage	✓		
6.	Individual and Team Work		✓	
7.	Communication		✓	
8.	Computing Professionalism and Society		✓	

9.	Ethics		✓	
10.	Life-long Learning			✓

Eligibility Criteria, Duration of the Program and Award of Degree

- The minimum requirements for admission in BS Software Engineering is F.Sc Pre-Engineering OR Equivalent, F.Sc. Pre-Medical, FCS/F.Sc Computer Science, DAE with at least 50% marks.
- The students who have not studied Mathematics at intermediate level have to pass deficiency courses of Mathematics (06 credits) in the first two semesters.
- At minimum 130 credit hours are required for award of BS degrees in any computing discipline mentioned in this document.
- The minimum duration for completion of BS Computing degrees is four years. The HEC allows maximum period of seven years to complete BS degree requirements.
- A minimum 2.0 CGPA (Cumulative Grade Point Average) on a scale of 4.0 is required for award of BS Computing Degree.
- The students after successful completion of 04 semesters in BS Computing Programs may exit with Associate Degree in Computing subject to completion of all requirements for the award of associate degree, i.e., Credit Hours, CGPA, and compulsory courses.

Curriculum Model for BS Software Engineering (BS SE)

The generic structure for the computing degree program given before is mapped with the BSSE program in the following tables.

Program Generic Structure

		NCEAC/HEC Proposed		ICP BS SE Program	
Categories (Cat)	Cat Code	No. of Courses	Credit Hours	No. of Courses	Credit Hours
Computing Core (CC)	1	14	46	14	46
Domain Core (DC)	2	6	18	6	18
Domain Elective (DE)	3	7	21	7	21
General Education Requirements (GER)	4	15	34	15	34
Mathematics & Supporting Courses (MSC) or Interdisciplinary Courses	5	4	12	4	12
Elective Supporting Courses (ESC)	6	1	3	1	3
Field Experience/Internship	7	01	03	01	03
Total		48	137	48	137

Proposed Semester/Study Plan for BS Software Engineering (BSSE)

4-Year Program (8 Regular Semesters of 16 weeks each)

Semester 1 (18 Credit Hours)				
Course Code	**Course Title**	**Cr.Hr**	**Domain**	**Pre-Requisite**
CSC-140	Application of Information and Communication Technologies	3 (2-1)	GER	
CSC-110	Programming Fundamentals (PF)	4 (3-1)	CC	
	Islamic Studies	2 (2-0)	GER	
	Natural Sciences Elective (Applied Physics)	3 (3-0)	GER	
	Functional English (FE)	3 (3-0)	GER	
	Pakistan Studies	2 (2-0)	GER	
	Understanding of Holy Quran-I	1 (0-1)	GER	
	*Pre-Calculus-I	Non-Credit		
	Semester Total	**18 (16-2)**		
* Non-Credit course. Students with pre-medical, have to pass deficiency courses of Mathematics of 6 credit hours; preferably within first year of enrolment in the program.				

Semester 2 (18 Credit Hours)				
Course Code	**Course Title**	**Cr.Hr**	**Domain**	**Pre-Requisite**
CSC-143	Discrete Structures	3 (3-0)	GER	
	Expository Writing (EW)	3 (3-0)	GER	FE
CSC-111	Object Oriented Programming (OOP)	4 (3-1)	CC	PF
	Ideology and Constitution of Pakistan	2 (2-0)	GER	
CSC-113	Digital Logic Design	3 (3-0)	CC	
	Social Science Elective (Introduction to Psychology)	2 (2-0)	GER	
	Understanding of Holy Quran-II	1 (1-0)	GER	
	* Pre-Calculus-II	Non-Credit		
	Semester Total	**18 (17-1)**		

Semester 3 (18 Credit Hours)				
Course Code	**Course Title**	**Cr.Hr**	**Domain**	**Pre-Requisite**
CSC-218	Software Engineering	3 (3-0)	CC	
CSC-214	Data Structures	4 (3-1)	CC	OOP
CSC-212	Database Systems (DB)	4 (3-1)	CC	
	Calculus and Analytic Geometry (CAG)	3 (3-0)	GER	
CSC-249	Arts & Humanities (Professional Practices)	2 (2-0)	GER	
CSC-2410	Civics and Community Engagement	2 (2-0)	GER	
	Semester Total	**18 (16-2)**		

Semester 4 (18 Credit Hours)				
Course Code	Course Title	Cr.Hr	Domain	Pre-Requisite
CSC-217	Computer Networks	3 (2-1)	CC	
CSC-219	Computer Organization & Assembly Language (COAL)	3 (2-1)	CC	DLD
CSC-2111	Analysis of Algorithms	3 (3-0)	CC	DS
	Linear Algebra	3 (3-0)	MSC	CAG
CSC-216	Artificial Intelligence	3 (2-1)	CC	
	Probability & Statistics	3 (3-0)	MSC	
	Semester Total	**18 (15-3)**		

Semester 5 (17 Credit Hours)				
Course Code	Course Title	Cr.Hr	Domain	Pre-Requisite
	Multivariable Calculus	3 (3-0)	MSC	CAG
SWE-320	Software Requirement Engineering	3 (3-0)	DC	SE
SWE-321	Software Design & Architecture (SDA)	3 (3-0)	DC	SE
CSC-3110	Operating Systems (OS)	3 (2-1)	CC	
	Domain Elective 1	3 (2-1)	DE1	
CSC-3411	Entrepreneurship	2 (2-0)	GER	
	Semester Total	**17 (15-2)**		

Semester 6 (18 Credit Hours)				
Course Code	Course Title	Cr.Hr	Domain	Pre-Requisite
SWE-322	Software Construction & Development	3 (2-1)	DC	SDA
	Domain Elective 2	3 (2-1)	DE2	
	Domain Elective 3	3 (2-1)	DE3	
SWE-323	Software Quality Engineering	3 (2-1)	DC	SE
CSC-315	Information Security	3 (3-0)	CC	
CSC-353	Technical and Business Writing	3 (3-0)	MSC	EW
	Semester Total	**18 (14-4)**		

Semester 7 (15 Credit Hours)				
Course Code	Course Title	Cr.Hr	Domain	Pre-Requisite
SWE-424	Software Project Management	3 (2-1)	DC	
	Domain Elective 4	3 (3-0)	DE4	
	Domain Elective 5	3 (3-0)	DE5	
CSC-464	Digital Marketing	3 (3-0)	ESC	
CSC-4112	Final Year Project-1	3 (0-3)	CC	
	Semester Total	**15 (11-4)**		
Semester 8 (12 Credit Hours)				

Course Code	Course Title	Cr.Hr	Domain	Pre-Requisite
CSC-425	Parallel and Distributed Computing	3 (2-1)	DC	OS
	Domain Elective 6	3 (2-1)	DE6	
	Domain Elective 7	3 (2-1)	DE7	
CSC-4113	Final Year Project-II	3 (0-3)	CC	FYP-I
	Seerat Un Nabi	Non-Credit		
	Semester Total	**12 (6-6)**		

Summary of Total Credit Hours for BS (SE) Program

Semesters	**1st**	**2nd**	**3rd**	**4th**	**5th**	**6th**	**7th**	**8th**	**Total**
Credit Hours	18	18	18	18	17	18	15	12	137