

Merit, Quality & Excellence



SUKKUR IBA UNIVERSITY DEPARTMENT OF COMPUTER SCIENCE

Annexure-II Study Schema of Bachelor of Science in Software Engineering BS (SE) (Fall 2024 - onwards)

Introduction

Software Engineering is the discipline of developing and maintaining software systems that behave reliably and efficiently and are affordable to develop and maintain. However, more recently it has evolved in response to the increased importance of software in safety-critical applications and to the growing impact of large and expensive software systems in a wide range of situations. The following describes an overview of Software Engineering.

- To provide software development practices requires more than just the underlying principles of computer science; it offers the rigor that the engineering disciplines bring to the reliability and trustworthiness of the artefacts.
- Software Engineering is different in character from other engineering disciplines, due to both the intangible nature of software and to the discontinuous nature of software operation.
- It seeks to integrate the science of Computer Science with the engineering principles developed for tangible and physical phenomena.

Software plays a central and underpinning role in almost all aspects of daily life: communications, government, manufacturing, banking and finance, education, transportation, entertainment, medicine, agriculture, and law. The number, size, and application domains of computer programs have grown dramatically; as a result, huge sums are being spent on software development. Most people's lives and livelihoods depend on this development's effectiveness. Software products help us to be more efficient and productive. They provide information, make us more effective problem solvers, and provide us with safer, flexible, and less confining work, entertainment, and recreation environments.

Software Engineering 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 department aims to train students in all aspects of software life cycle from specification through analysis and design to testing, maintenance and evolution of software product.

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 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 130 credit hours.

b) Must have earned CGPA (Cumulative Grade Point Average) of at least 2.0 on a scale of 4.0.

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

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 <u>www.seoulaccord.org</u>).

S. No.	Graduate Attributes (GAs)	Computing Professional Graduate Outcomes
1	Academic Education	To prepare graduates as SE professionals
2	Knowledge for Solving Computing Problems	Apply knowledge of SE, knowledge of an SE specialization, and mathematics, science, and domain knowledge appropriate for the SE specialization to the abstraction and conceptualization of SE models from defined problems and requirements
3	Problem Analysis	Identify, formulate, research literature, and solve complex SE-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 SE 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 SE 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	SE 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 SE practice
9	Ethics	Understand and commit to professional ethics, responsibilities, and norms of professional SE practice
10	Life-long Learning	Recognize the need, and have the ability, to engage in independent learning for continual development as a SE professional

Program Educational Objectives

- 1. Adequate Domain Knowledge: Produce graduates with adequate knowledge of core software engineering, mathematics and science fitting to the discipline, and skills to qualify and become competent software engineers, application developers and system analysts.
- 2. Critical Analysis and Problem Solution: Produce graduates who can critically analyze a problem and develop appropriate software solutions by identifying the software requirements for that solution.
- 3. Software Engineering Tools and Methods: Produce graduates, who can use appropriate software engineering tools and methods to model, simulate and test their designs.
- 4. Awareness of state-of-the-art Technologies: Produce graduates aware of technological advancements in the field of software engineering.
- 5. Effective Communication: Produce graduates who can effectively communicate their ideas and work, both orally and in writing with diverse stakeholders.
- 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

	Graduate Attributes (GAs)									
PEOs	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 SE 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 SE 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 130 for BS (SE) program.
- The program comprises eight semesters spread over four years.
- The following table gives the distribution of credit hours in different domains of knowledge.

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	30	12
Total	130	44

Generic Structure of Computing Discipline

Mapping of BSSE Program on the Generic Structure

S. No Semester Code Pre- Reg		Pre- Reg	Course Title	Domain	Credit Hours						
	Computing Core (46/130) 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 (need to be removed)	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	CS203		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 (18/130) 6 Courses							
15	4	CS255		Software Design & Architecture	Domain Core	3(3-0)					
16	4	CS256		Software Construction & Development	Domain Core	3(2-3)					
17	6	CS353		Software Project Management	Domain Core	3(2-3)					
18	5	CS304		Software Quality Engineering	Domain Core	3(2-3)					
19	5	CS305		Software Requirement Engineering	Domain Core	3(3-0)					
20	6	CS351	OS	Parallel & Distributed Computing	Domain Core	3(2-3)					
			Mather	natics & Supporting Courses (12/130) 4 Courses							

21	3	MT201	CAG	Multivariable 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)
	Gen	eral Educ	cation Req	uirement as per HEC UG Education Policy (30/130) 1	2 Courses	
25	1	GE101	_	Application of Information & Communication	GER	3(2-3)
		OF 105		Technologies	<u>CER</u>	
26	1	GE105	- D-D	Functional English	GER	3(3-0)
27	2	GE152	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	3	GE201		Ideology and Constitution of Pakistan	GER	2(2-0)
32	8	GE450		Social Sciences (Example: Introduction to	GER	2(2-0)
				Management)		
33	2	GE150		Natural Sciences (Applied Physics)	GER	3(2-3)
34	8	GE451		Arts & Humanities (Professional Practices)	GER	2(2-0)
35	8	GE452		Civics and Community Engagement	GER	2(2-0)
36	7	GE401		Entrepreneurship	GER	2(2-0)
			List of	Elective Supporting Courses (3/130) 1 Course		
37	7	SS401		Social Science (Example: Introduction to Marketing)	SS	3(3-0)
38		SS4xx		Social Science (Example: Financial Accounting)	SS	3(3-0)
39		SS4xx		Research Methods	SS	3(3-0)
40		SS4xx		Organizational Behavior	SS	3(3-0)
41		SS4xx		International Relations	SS	3(3-0)
42						
43						
44						
45						
				Domain Elective (21/130) 7 Courses		
46	5	CS3xx		Web technologies	Domain Elec	3(2-3)
47	5	CS3xx		Mobile Application Development 1	Domain Elec	3(2-3)
48	6	CS3xx		Mobile Application Development 2	Domain Elec	3(2-3)
49	6	CS3xx		Advanced Programming (Old Name: Visual Programming)	Domain Elec	3(2-3)
50	6	CS3xx		Web Engineering	Domain Elec	3(2-3)
51	6	CS3xx		Cyber Security	Domain Elec	3(3-0)
52	7	CS4xx		Software Testing & Quality Assurance	Domain Elec	3(2-3)
53		CSxxx		Cloud Computing	Domain Elec	3(2-3)
54		CSxxx		Computer Graphics	Domain Elec	3(2-3)
55		CSxxx		Object Oriented Analysis & Design	Domain Elec	3(2-3)
56		CSxxx		Natural Language Processing	Domain Elec	3(2-3)
57		CSxxx		Speech Processing	Domain Elec	3(2-3)
58		CSxxx		Data Mining	Domain Elec	3(2-3)
59		CSxxx		Advanced Statistics	Domain Elec	3(3-0)
60		CSxxx		Reinforcement Learning	Domain Elec	3(2-3)
61		CSxxx		Theory of Automata	Domain Elec	3(3-0)
62		CSxxx		HCI & Computer Graphics	Domain Elec	3(2-3)
63		CSxxx		Fuzzy Systems	Domain Elec	3(3-0)
64		CSxxx		Swarm Intelligence	Domain Elec	3(3-0)
65		CSxxx		Agent Based Modeling	Domain Elec	3(3-0)
66		CSxxx		Knowledge Based Systems	Domain Elec	3(3-0)
67		CSxxx		Web Engineering	Domain Elec	3(2-3)
		CC	1	Encateral Development Technologies	Domain Elas	3(2, 3)

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

#	Code	Pre-Reqs	Course Title	Domain	Cr hr (Cont hr)
Sem	ester 1	·			
1	CS102		Programming Fundamentals	Core	4 (3-3)
2	GE101		Application of Information & Communication	GER	3 (2-3)
3	GE104		QR 1 (Discrete Structures)	GER	3 (3-0)
4	GE102/		Islamic Studies / Ethics	GER	2 (2-0)
5	GE105 GE105		Functional English	GER	3 (3-0)
-	MT101		Additional Math-I (for Pre-Medical Students)		- ()
				Total Cr Hrs	15 (13-6)
	1		Semester 2	1	
6	CS150	PF- CS102	Object Oriented Programming	Core	4 (3-3)
7	CS151		Database Systems	Core	4 (3-3)
8	GE150		Natural Science (Applied Physics)	GER	3 (2-3)
9	GE151		Calculus and Analytic Geometry	GER	3 (3-0)
10	CE152	FE-	Even onito w Writing	CER	2 (2 0)
10	GE152	GE105	Expository writing	GER	3 (3-0)
	MT150		Additional Math-II (for Pre-Medical Studentss)		
				Total Cr Hrs	17 (14-9)
	1		Semester 3	1	1
11	CS201	PF- CS101	Data Structures	Core	4 (3-3)
12	MT201	CAG- GE151	Multivariable Calculus	Maths	3 (3-0)
13	CS202		Digital Logic Design	Core	3 (2-3)
14	CS203		Computer Networks	Core	3 (2-3)
15	CS204		Software Engineering	Core	3 (3-0)
16	GE201		Ideology and Constitution of Pakistan	GER	2 (2-0)
				Total Cr Hrs	18 (15-9)
			Semester 4		
17	CS250	DLD- CS202	Computer Organization & Assembly Language	Core	3 (2-3)
18	CS255		Domain Core 1 (Software Design & Architecture)	Domain Core	3 (3-0)
19	CS256		Domain Core 2 (Software Construction & Development)	Domain Core	3 (2-3)
20	CS253		Artificial Intelligence	Core	3 (2-3)
21	CS254		Information Security	Core	3 (3-0)
22	MT250		Probability & Statistics	Maths	3 (3-0)
				Total Cr Hrs	18(15-9)
			Semester 5		
23	CS301		Operating Systems	Core	3 (2-3)
24	CS304		Domain Core 3 (Software Quality Engineering)	Domain Core	3 (2-3)
25	CS305	1	Domain Core 4 (Software Requirement Engineering)	Domain Core	3 (3-0)
26	CS3xx		Domain Elective 1	Domain Elective	3 (2-3)
27	CS3xx		Domain Elective 2	Domain Elective	3 (2-3)
28	MT301	CAG- GE151	Linear Algebra	Maths	3 (3-0)

Suggested Semester/Study Plan for BSSE

		Total Cr Hrs	18 (14-12)
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	Semester 6							
29	CS353		Domain Core 5 (Software Project Management)	Domain Core	3 (2-3)			
30	CS351	OS- CS301	Domain Core 6 (Parallel & Distributed Computing)	Domain Core	3 (2-3)			
31	CS3xx		Domain Elective 3	Domain Elective	3 (2-3)			
32	CS3xx		Domain Elective 4	Domain Elective	3 (2-3)			
33	EN350		Technical & Business Writing	EN	3 (3-0)			
34	CS352	DS- CS201	Analysis of Algorithm	Core	3 (3-0)			
				Total Cr Hrs	18 (14-12)			
			Semester 7					
35	CS401		Final Year Project - I	Core	2 (0-6)			
36	CS4xx		Domain Elective 5	Domain Elective	3 (2-3)			
37	CS4xx		Domain Elective 6	Domain Elective	3 (2-3)			
38	CS4xx		Domain Elective 7	Domain Elective	3 (2-3)			
39	SS401		Elective Supporting Course (Example: Introduction to Marketing)	SS	3 (3-0)			
40	GE401		Entrepreneurship	GER	2 (2-0)			
				Total Cr Hrs	16 (12-15)			
	Semester 8							
41	CS450		Final Year Project - II	Core	4 (0-12)			
42	GE450		Social Science (Example: Introduction to Management)	GER	2 (2-0)			
43	GE451		Arts & Humanities (Professional Practices)	GER	2 (2-0)			
44	GE452		Civics and Community Engagement	GER	2 (2-0)			
				Total Cr Hrs	10 (6-12)			

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