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Faculty of

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2024-25

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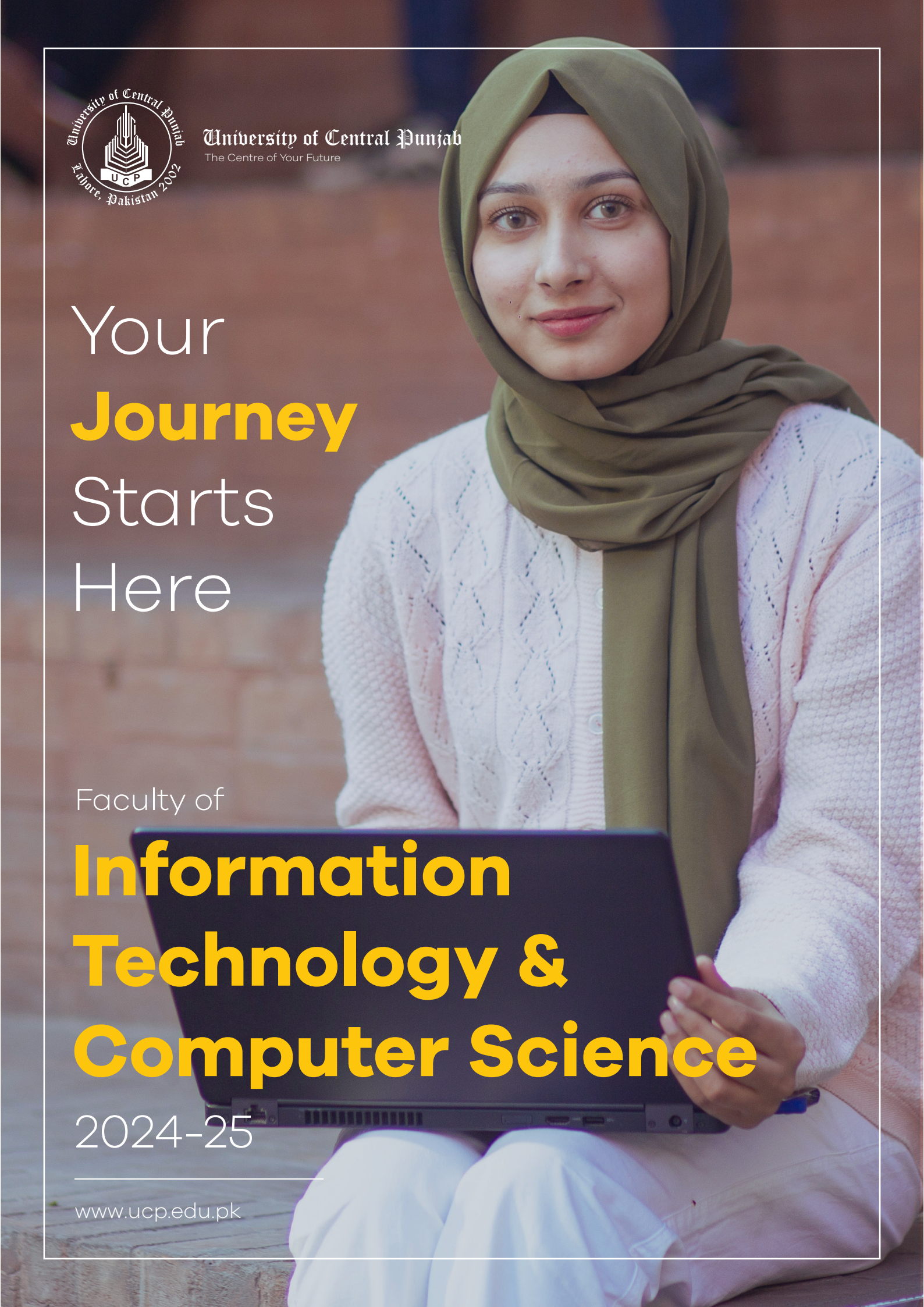

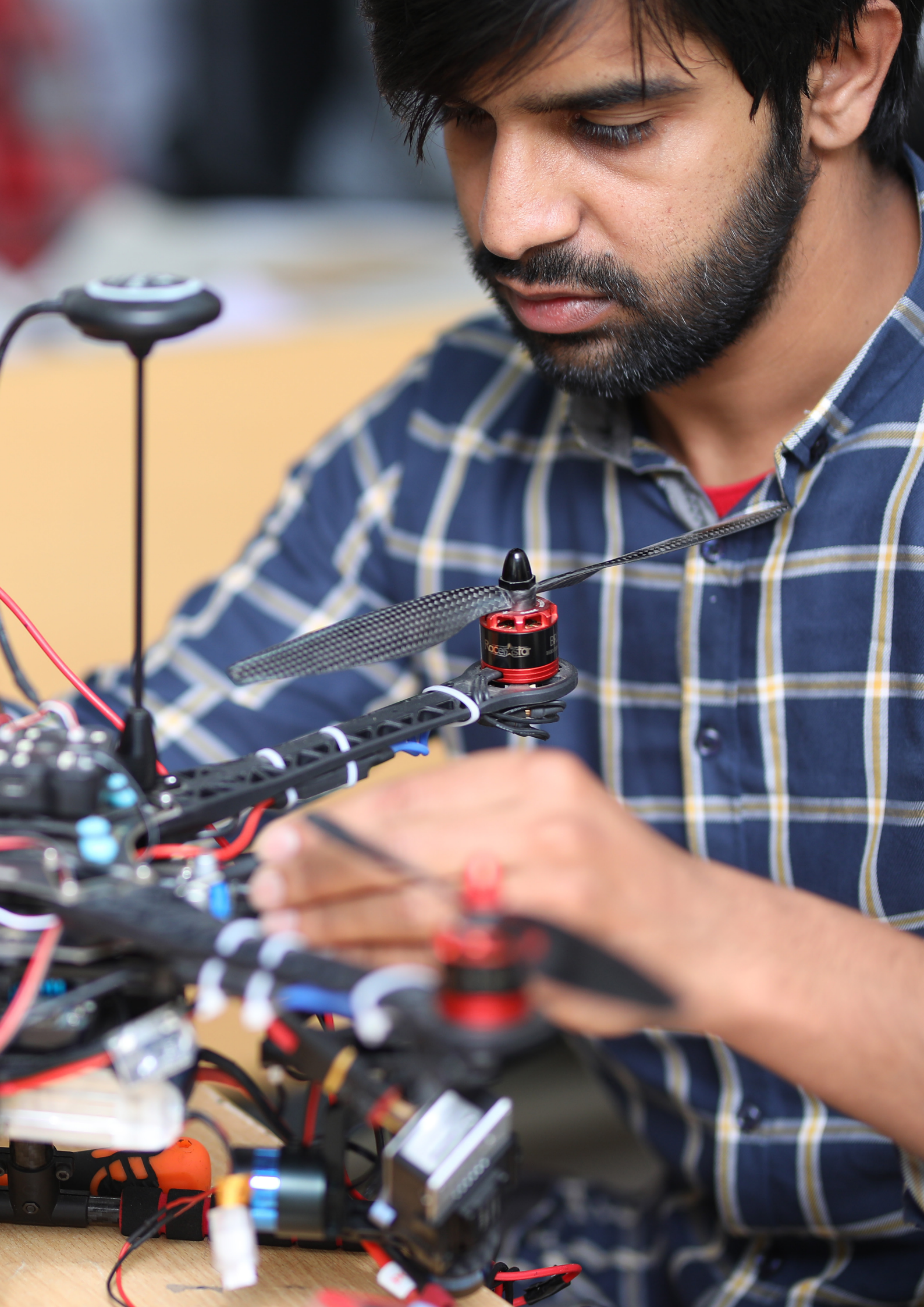

BS
Computer Science

1.1 Admission Requirements

(i) At least 50% marks in Intermediate (F.Sc. Pre-Engineering/ICS/Pre-Medical/A Levels examination or equivalent qualification with Mathematics certified by IBCC
(ii) All applicants are required to pass UCP Admission Test

1.2 Degree Requirements

Each candidate for the BS Computer Science degree is required to successfully earn 133 Cr. Hrs. with a minimum CGPA of 2.00 on a scale of 4.00 as per the following details:

	Area	Cr. Hrs.
a)	Core Courses	61
b)	Math Science Foundation Courses**	12
c)	Humanities Courses	18
d)	Supporting Courses	09
e)	CS Elective Courses	15
f)	UCP Elective Courses	12
g)	Design Project	06
	Total	**133**

Note**: Pre-Medical Students have to pass 2 additional mathematics deficiency courses of 6 credit hours within one year of their regular bachelor studies.

a) Core Courses (61 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Introduction to Computing	CSCS1513	3
Introduction to Computing Lab	CSCS1511	1
Programming Fundamentals	CSCP1013	3
Programming Fundamentals Lab	CSCP1011	1
Object Oriented Programming	CSCP2023	3
Object Oriented Programming Lab	CSCP2021	1
Data Structures and Algorithms	CSCP2033	3
Data Structures and Algorithms Lab	CSCP2031	1
Introduction to Database Systems	CSDB2313	3
Introduction to Database Systems-Lab	CSDB2311	1
Discrete Structures	CSAL1213	3
Operating Systems	CSCS3553	3
Operating Systems-Lab	CSCS3551	1
Software Engineering	CSSE3113	3
Computer Communications and Networks	CSNC2413	3
Computer Communications and Networks-Lab	CSNC2411	1
Information Security	CSNC3413	3

b) Computer Science Core (24 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Digital Logic and Design	CSCS2523	3
Digital Logic and Design Lab	CSCS2521	1
Computer Organization & Assembly Language	CSCS3543	3
Computer Organization & Assembly Lab Language	CSCS3541	1
Compiler Construction	CSCS4573	3
Design and Analysis of Algorithm	CSAL3233	3
Theory of Automata	CSAL3253	3
Parallel and Distributed Computing	CSCS2543	3
Artificial Intelligence	CSAL3243	3
Artificial Intelligence Lab	CSAL3241	1

c) Math Science Foundation Courses (12 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Calculus and Analytical Geometry	CSSS1713	3
Basic Electronics	CSSS1723	3
Probability and Statistics	CSSS2743	3
Linear Algebra	CSSS2753	3

d) Humanities Courses (18 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
English Composition & Comprehension	ENG101	3
Pakistan Studies	PAK101	2
Islamic Studies	ISL201	2
Communication & Presentation Skills	ENG102	3
Technical and Business Writing	ENG203	3
Professional Practices	CSGE4963	3
Fund. Of Entrepreneurship	ENT101	1
Career Lab	CLB301	1

e) Supporting Courses (09 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Supporting I	CSXXxxx3	3
Supporting II	CSXXxxx3	3
Supporting III	CSXXxxx3	3

Any 03 of the following courses:

Course Title	Code	Cr. Hrs.
Differential Equations	CSSS2763	3
Multivariate Calculus	CSSS2733	3
Numerical Computing	CSAL4263	3
Introduction to Graph Theory	CSAL4293	3
Theory of Programming Languages	CSAL5343	3

e) Supporting Courses (09 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
CS Elective I	CSXXxxx3	3
CS Elective II	CSXXxxx3	3
CS Elective III	CSXXxxx3	3

Course Title	Code	Cr. Hrs.
CS Elective IV	CSXXxxx3	3
CS Elective V	CSXXxxx3	3

List of Computer Science Electives

Following is a non-exhaustive list of elective courses. New elective courses may be added to this list. Students may be recommended to make their choice of electives, in the light of a soft specialization within the field of Computer science.

Course Title	Code	Cr. Hrs.
Web Application Development	CSSE3143	3
Computer Graphics	CSAL4273	3
Artificial Neural Networks	CSAL4283	3
Introduction to Speech Synthesis	CSAL4313	3
Introduction to Game Design	CSST3653	3
Mobile Application Development	CSCP3063	3
Introduction to Data Mining	CSDS3353	3
Game Modeling	CSST3613	3
Fuzzy Data Mining	CSAL3263	3
3D Computer Graphics	CSAL4323	3
Applied Design Patterns	CSCP4063	3
Web Information Retrieval	CSDB4353	3
Data Warehousing	CSDS4433	3
Big Data Analytics	CSDS4473	3
Web Engineering	CSSE4163	3
Software Testing	CSSE4193	3
Introduction to Computational Linguistics	CSAL4233	3
Visual Animation	CSST3673	3
Introduction to Image Processing	CSAL3203	3
Introduction to Computer Vision	CSDB3263	3
Programming for Big Data	CSDS4423	3
Microprocessor and Interfacing	CSST3623	3
FPGA Based System Design	CSST4613	3
Introduction to Robotics	CSST4693	3
System Programming	CSCP4073	3
Database Administration	CSDB4333	3
Data Network Security	CSNC3423	3
Block Chain Essentials	CSNC3443	3

Course Title	Code	Cr. Hrs.
Software Engineering II	CSSE3133	3
Introduction to Agile and Scrum	CSSE4133	3
Microprocessor Design	CSST3643	3
Advanced Game Development	CSST4663	3
Embedded System/Microcontroller Programing	CSST4683	3
Microcontroller Programming and Interfacing	CSST3663	3
Interactive Multimedia	CSST4653	3

f) UCP Elective Courses (12 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
University Elective I	CSXXxxx3	3
University Elective II	CSXXxxx3	3
University Elective III	CSXXxxx3	3
University Elective IV	CSXXxxx3	3

g) Design Project (06 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 06 Cr. Hrs. The project shall be completed in two parts as given below:

Course Title	Code	Cr. Hrs.
Final Year Project I	CSXXxxx3	3
Final Year Project II	CSXXxxx3	3

1.3 Community Service (CS4000)

Each student is required to complete 65 hours of community work, usually after 4th semester which would be a prerequisite to clear the student for the award of degree.

1.4 Program Duration

This is a four-year degree program comprising 8 semesters with a minimum of 133 Cr. Hrs. There will be a Fall and a Spring semester each year. The summer semester will be utilized for internship or deficiency courses. The minimum and maximum duration to complete BS Computer Science degree is 04 and 07 years, respectively.

Scheme of Studies

BS Computer Science

Semester-I (16 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	CSCS1513	Introduction to Computing	3	Core
2.	CSCS1511	Introduction to Computing Lab	1	Core
3.	CSHU2833	Logic Thinking (UCP Elective I)	3	Uni Elective
4.	ENG101	English Composition & Comprehension	3	Humanities
5.	CSSS1723	Basic Electronics	3	Math Science
6.	PAK101	Pakistan Studies	2	Humanities
7.	ENT101	Fundamentals of Entrepreneurship	1	Humanities
8.	CSSS1813	Pre-Calculus (Only for Pre-Medical)	3	Math Science

Semester-II (17 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	CSCP1013	Programming Fundamentals	3	Core
2.	CSCP1011	Programming Fundamentals Lab	1	Core
3.	CSCS2523	Digital Logic Design	3	Core
4.	CSCS2521	Digital Logic Design Lab	1	Core
5.	CSSS1713	Calculus and Analytical Geometry	3	Math Science
6.	ENG102	Communication & Presentation Skills	3	Humanities
7.	CSXXxxx3	UCP Elective-II	3	Uni Elective
8.	CSSS1853	Elementary Algebra (Only for Pre-Medical)	3	ELECTIVE Math Science

Semester-III (17 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	CSCP2023	Object Oriented Programming	3	Core
2.	CSCP2021	Object Oriented Programming Lab	1	Core
3.	CSCS3543	Computer Org. & Assembly Lang.	3	Core
4.	CSCS3541	Computer Org. & Assembly Lang. Lab	1	Core

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	CSXXxxx3	Supporting I	3	Supporting
2.	CSAL1213	Discrete Structures	3	Core
3.	ISL201	Islamic Studies	2	Humanities

Semester-IV (17 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	ENG203	Technical and Business Writing	3	Humanities
2.	CSCP2033	Data Structures and Algorithms	3	Core
3.	CSCP2031	Data Structures and Algorithms Lab	1	Core
4.	CSDB2313	Introduction to Database Systems	3	Core
5.	CSDB2311	Introduction to Database Systems Lab	1	Core
6.	CSSS2753	Linear Algebra	3	General Science
7.	CSXXxxx3	CS Elective 1	3	CS Elective

Semester-V (17 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	CSSE3113	Software Engineering	3	Core
2.	CSCS3553	Operating Systems	3	Core
3.	CSCS3551	Operating Systems Lab	1	Core
4.	CSXXxxx3	Supporting II	3	Supporting
5.	CSXXxxx3	CS Elective	3	CS Elective
6.	CSAL3233	Design and Analysis of Algorithms	3	Core

Semester-VI (17 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	CSAL3253	Theory of Automata	3	Core
2.	CSAL3243	Artificial Intelligence	3	Core
3.	CSAL3241	Artificial Intelligence Lab	1	Core
4.	CSNC2413	Computer Comm. and Networks	3	Core
5.	CSNC2411	Computer Comm. and Networks Lab	1	Core
6.	CSXXxxx3	CS Elective III	3	CS Elective
7.	CSSS2743	Probability and Statist	3	Math Science
8.	CLB301	Career Lab	1	Humanities

Semester-VII (18 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	CSCS4573	Compiler Construction	3	Core
2.	CSNC3413	Information Security	3	Core
3.	CSXXxxx3	Supporting III	3	Supporting
4.	CSXXxxx3	UCP Elective III	3	Uni Elective
5.	CSXXxxx3	CS Elective IV	3	CS Elective
6.	CSSE4173	Final Year Project I	3	Core

Semester-VIII (15 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	CSCS2543	Parallel and Distributed Computing	3	Core
2.	CSMG4963	Professional Practices	3	Humanities
3.	CSXXxxx3	CS Elective V	3	CS Elective
4.	CSXXxxx3	UCP Elective IV	3	Uni Elective
5.	CSSE4183	Final Year Project II	3	Core

BS Computer Science - Post ADP

1.1 Admission Requirements

(i) To apply for BS Computer Science-Post ADP, a candidate must have at least 50% marks in F.Sc. Pre-Engineering/Pre-Medical/ICS or equivalent along with minimum 45% marks or 2.00/4.00 CGPA in ADP Computer Science.
(ii) All applicants are required to pass UCP Admission Test.

1.2 Degree Requirements

Each candidate for the BS Computer Science degree is required to successfully earn 133 Cr. Hrs. with a minimum CGPA of 2.00 on a scale of 4.00 as per the following details:

BS
Data Science

1. Admission Requirements

I. At least 50% marks in Intermediate (HSSC) examination with Mathematics or equivalent qualification with Mathematics certified by IBCC.

II. At least 50% marks in Intermediate Pre-medical (subject combination of Physics, Chemistry and Biology) are also eligible to apply. Such candidates, if admitted, are required to study additional two Mathematics courses, worth 6 credit hours, during the first year of studies at the institution.

III. Applicant will clear UCP test or equivalent.

2. Degree Requirements

Each candidate for the BS Data Science degree is required to successfully earn 132 Cr. Hrs. with the minimum CGPA of 2.0 on the scale of 4.0 as per the following detail:

Area	Courses	Cr. Hrs.
Computing Core	14	47
Domain Core	6	18
Domain Elective	7	21
Mathematics & Supporting Courses**	4	12
Elective Supporting Courses	1	3
General Education Requirements	12	31
Total	**44**	**132**

** Pre-Medical students have to pass 2 additional mathematics deficiency courses of 6 credit hours within one year of their regular bachelor studies

2.1. Computing Core Courses (14 Courses) (47 Cr. Hrs.)

#	Course Title	Code	Cr. Hrs.
	COMPUTING CORE		
1	Programming Fundamentals	CP113	3
	Programming Fundamentals Lab	CP111	1
2	Object Oriented Programming	CP223	3
	Object Oriented Programming Lab	CP221	1
3	Data Structures	CP233	3
	Data Structures Lab	CP231	1
4	Database Systems	DB203	3
	Database Systems Lab	DB201	1
5	Operating Systems	AR332	2
	Operating Systems Lab	AR331	1
6	Software Engineering	SE203	3
7	Computer Networks	NS302	2
	Computer Networks Lab	NS301	1
8	Information Security	NS312	2
	Information Security Lab	NS311	1
9	Analysis of Algorithm	AL303	3
10	Digital Logic Design	AR102	2
	Digital Logic Design Lab	AR101	1
11	Artificial Intelligence	AL312	2
	Artificial Intelligence Lab	AL311	1
12	Computer Organization & Assembly Language	AR223	3
	Computer Organization & Assembly Language Lab	AR221	1
13	Final Year Project I	CP483	3
14	Final Year Project II	CP493	3

2.2. Domain Core Courses (18 Cr. Hrs.)

#	Course Title	Code	Cr. Hrs.
1	Introduction to Data Science	DS202	2
	Introduction to Data Science Lab	DS201	1
2	Advanced Statistics	DS382	2
	Advanced Statistics Lab	DS382	1
3	Data Warehousing & Business Intelligence	DS362	2
	Data Warehousing & Business Intelligence Lab	DS362	1
4	Parallel & Distributed Computing	CP442	2
	Parallel & Distributed Computing Lab	CP441	1
5	Data Visualization	DS452	2
	Data Visualization Lab	DS451	1
6	Data Mining	DS442	2
	Data Mining Lab	DS441	1

2.3. Data Science Elective Courses (21 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Domain Elective I		3
Domain Elective II		3
Domain Elective III		3
Domain Elective IV		3
Domain Elective V		3
Domain Elective VI		3
Domain Elective VII		3

List of Data Science Elective Courses: Following is a list of elective courses. New elective courses may be added to this list. Students may be recommended to make their choice of electives, in the light of a soft specialization.

#	Course Title	Code	Cr. Hrs.
1	Time Series Analysis	DS493	3
2	Programming for Big Data	DS412	2
	Programming for Big Data Lab	DS411	1
3	Evolutionary Computing	AI473	3
4	Pattern Recognition	AI393	3
5	Natural Language Processing	ML412	2
	Natural Language Processing (Lab)	ML411	1
6	Speech Processing	ML443	3
7	Big Data Analytics	DS422	2
	Big Data Analytics Lab	DS422	1
8	Machine Learning	ML302	2
	Machine Learning (Lab)	ML301	1
9	Theory of Automata	AL323	3
10	HCI & Computer Graphics	PBD472	2
	HCI & Computer Graphics (Lab)	PBD471	1
11	Swarm Intelligence	AI453	3
12	Agent Based Modeling	AI483	3
13	Knowledge Based Systems	AI463	3
14	Artificial Neural Networks & Deep Learning	AI342	2
	Artificial Neural Networks & Deep Learning Lab	AI341	1
15	Advance Database Management Systems	DB312	2
	Advance Database Management Systems Lab	DB311	1
16	Text Mining	DS373	3
17	Topics in Data Science	DS413	3

2.4. Mathematics & Supporting Courses (12 Cr. Hrs.)

#	Course Title	Code	Cr. Hrs.
1	Multivariable Calculus	MAT243	3
2	Linear Algebra	MAT233	3
3	Probability and Statistics	MAT253	3
4	Technical and Business Writing	ENG203	3
5*	Pre-Calculus (Only for Pre-Medical)	MAT103	3
6*	Elementary Algebra (Only for Pre-Medical)	MAT123	3

Elective Supporting Courses (3 Cr. Hrs)

#	Course Title	Code	Cr. Hrs.
1	Social Science		3

2.6. General Education Courses (31 Cr. Hrs.)

#	Course Title	Cr. Hrs.
1	Application of Information & Communication Technologies	4
2	Functional English	3
3	Expository Writing	3
4	Quantitative Reasoning – I	3
5	Quantitative Reasoning – II	3
6	Islamic Studies	2
7	Ideology and Constitution of Pakistan	2
8	Social Sciences	2
9	Natural Sciences	3
10	Arts & Humanities	2
11	Civics and Community Engagement	2
12	Entrepreneurship	2

List of General Education Courses: Following is a list of general education courses. New courses may be added to this list.

#	Course Title	Code	Cr. Hrs.
1	Introduction to Computing	CP103	3
	Introduction to Computing Lab	CP101	1
2	Calculus and Analytical Geometry	MAT113	3
3	Discrete Structures	AL143	3
4	English Composition & Comprehension (Functional English)	ENG110	3
5	Communication & Presentation Skills (Expository Writing)	ENG102	3
6	Pakistan Studies	PAK101	2
7	Islamic Studies	ISL201	2
8	Professional Practices	SEP203	2
9	Basic Electronics	GE102	2
	Basic Electronics Lab	GE1021	1
10	Civics and Community Engagement	SEP113	2
11	Ideology and Constitution of Pakistan	PAK102	2
12	Introduction to Psychology	PSY101	3
13	Foreign Language		3
14	Introduction to Business		3
15	Entrepreneurship		3
16	Creative Graphics		2
17	Fundamentals of Marketing		3
18	Enterprise Resource Planning		3
19	Human Resource Management		3
20	Financial Accounting		3

3. Design Project (06 Cr. Hrs.)

After the completion of 90 Cr. Hr., the students are required to demonstrate their practical skills in the field of Computer Science by designing and implementing a project worth of 06 Cr. Hrs. The project shall be completed in two parts as given below:

Course Title	Code	Cr. Hrs.
Final Year Project I	CP483	3
Final Year Project II	CP493	3

4. Community Service

Each student is required to complete 65 hours community work usually after 4th semester which would be prerequisite to clear the student for the award of degree.

5. Program Duration

This is a four-year degree program comprising of 08 semesters with a minimum of 132 Cr. Hrs. There will be Fall and Spring semesters each year. The summer semester will be utilized for internship of deficiency courses. The minimum and maximum duration to complete BS Data Science degrees is 04 and 07 years respectively.

Scheme of Studies

BS Data Science

Semester-I					
S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	CP103		Introduction to Computing (GE-I)	GER	3
	CP101		Introduction to Computing - Lab (GE-I)	GER	1
2	ENG110		Functional English (GE-II)	GER	3
3	GE102		Basic Electronics (GE-III)	GER	2
	GE101		Basic Electronics - Lab (GE-III)	GER	1
4	PAK102		Ideology and Constitution of Pakistan (GE-IV)	GER	2
5	AL143		QR 1 (Discrete Structures) (GE-V)	GER	3
6	MAT103		Pre-Calculus	(Only for Pre-medical Students)	3
Total					**15 (18)**

Theory Credit Hours	13 (16)	Lab Credit Hours	2
Theory Contact Hours	13 (16)	Lab Contact Hours	6

Semester-II					
S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	CP113	ITC	Programming Fundamentals	Computing Core	3
	CP111	ITC	Programming Fundamentals - Lab	Computing Core	1
2	AR102		Digital Logic Design	Computing Core	2
	AR101		Digital Logic Design - Lab	Computing Core	1
3	MAT113		QR 2 (Calculus and Analytic Geometry) (GE-VI)	GER	3
4	ENG102	FE	Expository Writing (GE-VII)	GER	3
5	SEP113		Civics and Community Engagement (GE-VIII)	GER	2
6	MAT123		Elementary Algebra	(Only for Pre-medical Students)	3
Total					**15 (18)**

Theory Credit Hours	13 (16)	Lab Credit Hours	2
Theory Contact Hours	13 (16)	Lab Contact Hours	6

Semester-III

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	CP223	PF	Object Oriented Programming	Computing Core	3
	CP221	PF	Object Oriented Programming - Lab	Computing Core	1
2	AR223	DLD	Computer Organization & Assembly Language	Computing Core	3
	AR221	DLD	Computer Organization & Assembly Language - Lab	Computing Core	1
3	MAT253		Probability & Statistics	Maths	3
4	SEP203		Arts & Humanities (Professional Practices) (GE-IX)	GER	2
5	MAT243	CAG	Multivariable Calculus	Maths	3
6	ENT201		Entrepreneurship (GE-X)	GER	2
	Total				**18**

Theory Credit Hours	16	Lab Credit Hours	2
Theory Contact Hours	16	Lab Contact Hours	6

Semester-IV

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	CP233	OOP	Data Structures	Computing Core	3
	CP231	OOP	Data Structures - Lab	Computing Core	1
2	DB203		Database Systems	Computing Core	3
	DB201		Database Systems - Lab	Computing Core	1
3			Social Sciences (GE-XI)	GER	2
4	DS202		Domain Core 1 (Introduction to Data Science)	Domain Core	2
	DS201		Domain Core 1 (Introduction to Data Science Lab)	Domain Core	1
5	MAT233	CAG	Linear Algebra	Maths	3
6	ISL201		Islamic Studies (GE- XII)	GER	2
	Total				**18**

Theory Credit Hours	15	Lab Credit Hours	3
Theory Contact Hours	15	Theory Contact Hours	9

Semester-V

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	SE203		Software Engineering	Domain Elective	3
2	AL312		Artificial Intelligence	Computing Core	2
	AL311		Artificial Intelligence - Lab	Computing Core	1
3	NS312		Information Security	Computing Core	2
	NS311		Information Security - Lab	Computing Core	1
4	AR332		Operating Systems	Computing Core	2
	AR331		Operating Systems - Lab	Computing Core	1
5	ENG203	FE	Technical & Business Writing	EN	3
6			Domain Elective 1	Domain Elective	3
	Total				**18**

Theory Credit Hours	15	Lab Credit Hours	3
Theory Contact Hours	15	Lab Contact Hours	9

Semester-VI

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	NS302		Computer Networks	Computing Core	2
	NS301		Computer Networks - Lab	Computing Core	1
2	AL303	DS	Analysis of Algorithms	Computing Core	3
3	DS382	DB	Domain Core 2 (Advanced Statistics)	Domain Core	2
	DS381	DB	Domain Core 2 (Advanced Statistics) - Lab	Domain Core	1
4			Domain Elective 2	Domain Elective	3
5	DS362	Data Science	Domain Core 3 (Data Warehousing & Business Intelligence)	Domain Core	2
	DS361	Data Science	Domain Core 3 (Data Warehousing & Business Intelligence) - Lab	Domain Core	1
6			Domain Elective 3	Domain Elective	3
	Total				**18**

Theory Credit Hours	15	Lab Credit Hours	3
Theory Contact Hours	15	Lab Contact Hours	9

Semester-VII

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1			Domain Elective 4	Domain Elective	3
2	CP483		Final Year Project - I	Computing Core	3
3	DS452	DW&BI	Domain Core 4 (Data Visualization)	Domain Core	2
	DS451	DW&BI	Domain Core 4 (Data Visualization) - Lab	Domain Core	1
4	DS442	Data	Domain Core 5 (Data Mining)	Domain Core	2
	DS441	Science,	Domain Core 5 (Data Mining) - Lab	Domain Core	1
5		Adv Stat	Domain Elective 5	Domain Elective	3
Total					**15**

Theory Credit Hours	10	Lab Credit Hours	5
Theory Contact Hours	10	Lab Contact Hours	15

Semester-VIII

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	CP442	OOP, OS	Domain Core 6 (Parallel & Distributed Computing)	Domain Core	2
	CP441	OOP, OS	Domain Core 6 (Parallel & Distributed Computing) - Lab	Domain Core	1
2	CP493	FYP-I	Final Year Project - II	Computing Core	3
3			Domain Elective 6	Domain Elective	3
4			Domain Elective 7	Domain Elective	3
5			Elective Supporting Course	SS	3
Total					**15**

Theory Credit Hours	11	Lab Credit Hours	4
Theory Contact Hours	11	Lab Contact Hours	12

Note: A Domain Elective course can be with or without lab as per department's offering. However, it will be at least three credit hours.

BS
Artificial Intelligence

1.1 Admission Requirements

I. At least 50% marks in Intermediate (HSSC) examination with Mathematics or equivalent qualification with Mathematics certified by IBCC.

II. At least 50% marks in Intermediate Pre-medical (subject combination of Physics, Chemistry and Biology) are also eligible to apply. Such candidates, if admitted, are required to study additional two Mathematics courses, worth 6 credit hours, during the first year of studies at the institution.

III. Applicant will clear UCP test or equivalent.

2. Degree Requirements

Each candidate for the BS Artificial Intelligence degree is required to successfully earn 132 Cr. Hrs. with the minimum CGPA of 2.0 on the scale of 4.0 as per the following detail:

Area	Cr. Hrs.	Credit Hours
Computing Core	14	47
Domain Core	6	18
Domain Elective	7	21
Mathematics & Supporting Courses**	4	12
Elective Supporting Courses	1	3
General Education Requirements	12	31
Total	**44**	**132**

Note:** Pre-Medical students have to pass 2 additional mathematics deficiency courses of 6 credit hours within one year of their regular bachelor studies

2.1. Computing Core Courses (14 Courses) (47 Cr. Hrs.)

#	Course Title	Code	Cr. Hrs.
	COMPUTING CORE		
1	Programming Fundamentals	CP113	3
	Programming Fundamentals Lab	CP111	1
2	Object Oriented Programming	CP223	3
	Object Oriented Programming Lab	CP221	1
3	Data Structures	CP233	3
	Data Structures Lab	CP231	1
4	Database Systems	DB203	3
	Database Systems Lab	DB201	1
5	Operating Systems	AR332	2
	Operating Systems Lab	AR331	1
6	Software Engineering	SE203	3
7	Computer Networks	NS302	2
	Computer Networks Lab	NS301	1
8	Information Security	NS312	2
	Information Security Lab	NS311	1
9	Analysis of Algorithm	AL303	3
10	Digital Logic Design	AR102	2
	Digital Logic Design Lab	AR101	1
11	Artificial Intelligence	AL312	2
	Artificial Intelligence Lab	AL311	1
12	Computer Organization & Assembly Language	AR223	3
	Computer Organization & Assembly Language Lab	AR221	1
13	Final Year Project I	CP483	3
14	Final Year Project II	CP493	3

2.2. Domain Core Courses (18 Cr. Hrs.)

#	Course Title	Code	Cr. Hrs.
1	Programming for AI	AI302	2
	Programming for AI Lab	AI301	1
2	Machine Learning	ML302	2
	Machine Learning Lab	ML301	1
3	Artificial Neural Networks & Deep learning	AI342	2
	Artificial Neural Networks & Deep learning Lab	AI341	1
4	Parallel & Distributed Computing	CP442	2
	Parallel & Distributed Computing Lab	CP441	1
5	Computer Vision	AI422	2
	Computer Vision Lab	AI421	1
6	Knowledge Representation & Reasoning	AI412	2
	Knowledge Representation & Reasoning Lab	AI411	1

2.3. Artificial Intelligence Elective Courses (21 Cr. Hrs.)

#	Course Title	Code	Cr. Hrs.
1	Domain Elective I		3
2	Domain Elective II		3
3	Domain Elective III		3
4	Domain Elective IV		3
5	Domain Elective V		3
6	Domain Elective VI		3
7	Domain Elective VII		3

List of Artificial Intelligence Elective Courses: Following is a list of elective courses. New elective courses may be added to this list. Students may be recommended to make their choice of electives, in the light of a soft specialization.

#	Course Title	Code	Cr. Hrs.
1	Robotics and Autonomous Systems	AR483	3
2	Programming for Big Data	DS412	2
	Programming for Big Data Lab	DS411	1
3	Evolutionary Computing	AI473	3
4	Pattern Recognition	AI393	3
5	Natural Language Processing	ML412	2
	Natural Language Processing Lab	ML411	1
7	Speech Processing	ML443	3
8	Big Data Analytics	DS422	2

#	Course Title	Code	Cr. Hrs.
	Big Data Analytics Lab	DS422	1
9	Machine Learning	ML302	2
	Machine Learning Lab	ML301	1
10	Theory of Automata	AL323	3
11	HCI & Computer Graphics	PBD472	2
	HCI & Computer Graphics Lab	PBD471	1
12	Swarm Intelligence	AI453	3
13	Agent Based Modeling	AI483	3
14	Knowledge Based Systems	AI463	3
15	Advance Database Management Systems	DB312	2
	Advance Database Management Systems Lab	DB311	1
16	Text Mining	DS373	3
17	Topics in Data Science	DS413	3

2.4. Mathematics & Supporting Courses (12 Cr. Hrs.)

#	Course Title	Code	Cr. Hrs.
1	Multivariable Calculus	MAT243	3
2	Linear Algebra	MAT233	3
3	Probability and Statistics	MAT253	3
4	Technical and Business Writing	ENG203	3
5*	Pre-Calculus (Only for Pre-Medical)	MAT103	3
6*	Elementary Algebra (Only for Pre-Medical)	MAT123	3

2.5. Elective Supporting Courses (3 Cr. Hrs)

#	Course Title	Code	Cr. Hrs.
1	Social Science		3

2.6. General Education Courses (31 Cr. Hrs.)

#	Course Title	Cr. Hrs.
1	Application of Information & Communication Technologies	4
2	Functional English	3
3	Expository Writing	3
4	Quantitative Reasoning – I	3
5	Quantitative Reasoning – II	3
6	Islamic Studies	2
7	Ideology and Constitution of Pakistan	2
8	Social Sciences	2
9	Natural Sciences	3
10	Arts & Humanities	2
11	Civics and Community Engagement	2
12	Entrepreneurship	2

List of General Education Courses: Following is a list of general education courses. New courses may be added to this list.

#	Course Title	Code	Cr. Hrs.
1	Introduction to Computing	CP103	3
2	Introduction to Computing Lab	CP101	1
3	Calculus and Analytical Geometry	MAT113	3
4	Discrete Structures	AL143	3
5	English Composition & Comprehension (Functional English)	ENG101	3
6	Communication & Presentation Skills (Expository Writing)	ENG102	3
7	Pakistan Studies	PAK101	2
8	Islamic Studies	ISL201	2
9	Professional Practices	SEP203	2
10	Basic Electronics	GE102	2
11	Basic Electronics Lab	GE1021	1
12	Civics and Community Engagement	SEP113	2
13	Ideology and Constitution of Pakistan	PAK102	2
14	Introduction to Psychology	PSY101	3
15	Foreign Language		3
16	Introduction to Business		3
17	Entrepreneurship		3
18	Creative Graphics		2
19	Fundamentals of Marketing		3

#	Course Title	Code	Cr. Hrs.
20	Enterprise Resource Planning		3
21	Human Resource Management		3
21	Financial Accounting		3

3. Design Project (06 Cr. Hrs.)

After the completion of 90 Cr. Hr., the students are required to demonstrate their practical skills in the field of Computer Science by designing and implementing a project worth of 06 Cr. Hrs. The project shall be completed in two parts as given below:

#	Course Title	Code	Cr. Hrs.
1	Final Year Project I	CP483	3
2	Final Year Project II	CP493	3

4. Community Service

Each student is required to complete 65 hours community work usually after 4th semester which would be prerequisite to clear the student for the award of degree.

5. Program Duration

This is a four-year degree program comprising of 08 semesters with a minimum of 132 Cr. Hrs. There will be Fall and Spring semesters each year. The summer semester will be utilized for internship of deficiency courses. The minimum and maximum duration to complete BS Artificial Intelligence degrees is 04 and 07 years respectively.


NORTON SHAKESPEARE
CRACKING
MODERN CRITICAL INTERPRETATIONS
William Golding The Pyramid
The Spire William Golding
THINNER THAN
Postcolonial Imaginings
NERUDA
SPEECH

Bachelor of Science in Artificial Intelligence (BSAI) - Roadmap

Semester-I				
S. No	Course Code	Course	Domain	Cr. Hrs.
1	CP103	Introduction to Computing (GE-I)	GER	3
	CP101	Introduction to Computing - Lab (GE-I)	GER	1
2	ENG110	Functional English (GE-II)	GER	3
3	GE102	Basic Electronics (GE-III)	GER	2
	GE101	Basic Electronics - Lab (GE-III)	GER	1
4	PAK102	Ideology and Constitution of Pakistan	GER	2
5	AL143	(GE-IV)	GER	3
6	MAT103	QR 1 (Discrete Structures) (GE-V) Pre-Calculus	(Only for Pre-medical Students)	3
Total				**15 (18)**

Theory Credit Hours	13 (16)	Lab Credit Hours	2
Theory Contact Hours	13 (16)	Lab Contact Hours	6

Semester-II					
S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	CP103	ITC	Programming Fundamentals	Computing Core	3
	CP101	ITC	Programming Fundamentals - Lab	Computing Core	1
2	ENG110		Digital Logic Design	Computing Core	2
	GE102		Digital Logic Design - Lab	Computing Core	1
3	GE101		QR 2 (Calculus and Analytic	GER	3
4	PAK102	FE	Geometry) (GE-VI)		
5	AL143		Expository Writing (GE-VII)	GER	3
6	MAT103		Civics and Community Engagement (GE-VIII)	GER	2
			Elementary Algebra	(Only for Pre-medical Students)	3
Total					**15 (18)**

Theory Credit Hours	13 (16)	Lab Credit Hours	2
Theory Contact Hours	13 (16)	Lab Contact Hours	6

Semester-III					
S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	CP223	PF	Object Oriented Programming	Computing Core	3
	CP221	PF	Object Oriented Programming - Lab	Computing Core	1
2	AR223	DLD	Computer Organization & Assembly Language	Computing Core	3
	AR221	DLD	Computer Organization & Assembly Language - Lab	Computing Core	1
3	MAT253		Probability & Statistics	Maths	3
4	SEP203		Arts & Humanities (Professional Practices) (GE-IX)	GER	2
5	MAT243	CAG	Multivariable Calculus	Maths	3
6	ENT201		Entrepreneurship (GE-X)	GER	2
Total					**18**

Theory Credit Hours	16	Lab Credit Hours	2
Theory Contact Hours	16	Lab Contact Hours	6

Semester-IV

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	CP233	OOP	Data Structures	Computing Core	3
	CP231	OOP	Data Structures - Lab	Computing Core	1
2	DB203		Database Systems	Computing Core	3
	DB201		Database Systems - Lab	Computing Core	1
3			Social Sciences (GE-XI)	GER	2
4	AL312		Artificial Intelligence	Computing Core	2
	AL311		Artificial Intelligence - Lab	Computing Core	1
5	MAT233	CAG	Linear Algebra	Maths	3
6	ISL201		Islamic Studies (GE- XII)	GER	2
			Total		**18**

Theory Credit Hours	15	Lab Credit Hours	3
Theory Contact Hours	15	Theory Contact Hours	9

Semester-V

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	SE203		Software Engineering	Domain Elective	3
2	NS312		Information Security	Computing Core	2
	NS311		Information Security - Lab	Computing Core	1
3	AR332		Operating Systems	Computing Core	2
	AR331		Operating Systems - Lab	Computing Core	1
4	ENG203	FE	Technical & Business Writing	EN	3
5			Domain Elective 1	Domain Elective	3
6	AI302	AI	Domain Core 1 (Programming for AI)	Domain Core	2
	AI301	AI	Domain Core - I (Programming for AI) - Lab	Domain Core	1
			Total		**18**

Theory Credit Hours	15	Lab Credit Hours	3
Theory Contact Hours	15	Lab Contact Hours	9

Semester-VI

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	NS302		Computer Networks	Computing Core	2
	NS301		Computer Networks - Lab	Computing Core	1
2	AL303	DS	Analysis of Algorithms	Computing Core	3
3	ML302	AI	Domain Core 2 (Machine Learning)	Domain Core	2
	ML301	AI	Domain Core 2 (Machine Learning) – Lab	Domain Core	1
4			Domain Elective 2	Domain Elective	3
5	AI342	Prog for AI	Domain Core 3 (Artificial Neural Networks & Deep learning)	Domain Core	2
	AI341	Prog for AI	Domain Core 3 (Artificial Neural Networks & Deep learning) - Lab	Domain Core	1
6			Domain Elective 3	Domain Elective	3
Total					**18**

Theory Credit Hours	15	Lab Credit Hours	3
Theory Contact Hours	15	Lab Contact Hours	9

Semester-VII

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1			Domain Elective 4	Domain Elective	3
2	CP483		Final Year Project - I	Computing Core	3
3	AI422	ANN& DL	Domain Core 4 (Computer Vision)	Domain Core	2
			Domain Core 4 (Computer Vision) - Lab		
	AI421	ANN& DL	Domain Core 5 (Knowledge Representation & Reasoning)	Domain Core	1
4					
	AI412	AI	Domain Core 5 (Knowledge	Domain Core	2
	AI411	AI	Representation & Reasoning) - Lab	Domain Core	1
5			Domain Elective 5	Domain Elective	3
Total					**15**

Theory Credit Hours	10	Lab Credit Hours	5
Theory Contact Hours	10	Lab Contact Hours	15

Semester-VIII					
S. No	**Course Code**	**Pre-Req**	**Course**	**Domain**	**Cr. Hrs.**
1	CP442	OOP, OS	Domain Core 6 (Parallel & Distributed Computing)	Domain Core	2
	CP441	OOP, OS	Domain Core 6 (Parallel & Distributed Computing) - Lab	Domain Core	1
2	CP493	FYP-	Final Year Project - II	Computing Core	3
3			Domain Elective 6	Domain Elective	3
4			Domain Elective 7	Domain Elective	3
5			Elective Supporting Course	SS	3
Total					**15**

Theory Credit Hours	11	Lab Credit Hours	4
Theory Contact Hours	11	Lab Contact Hours	12

Note: A **Domain Elective** course can be with or without lab as per department's offering. However, it will be at least three credit hours.

MS
Computer Science

1.1 Admission Requirements

(i) A minimum of 16 years of education leading to a BS in Computer Science/ Information Technology/Software Engineering or equivalent

(ii) Pre-requisite courses will be determined as per HEC policy (if any)

(iii) Minimum 2.00/4.00 CGPA or 50% marks from an annual system

(iv) All applicants are required to pass UCP Admission Test and interview

1.2 Degree Requirements

A student admitted to 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) Coursework only (10 Courses)

Each candidate for the MS Computer Science degree is required to successfully earn 30 Cr. Hrs. with a CGPA of 2.50 on a scale of 4.00 as per the following detail:

	Area	Cr. Hrs.
a)	Core Courses	12
b)	Electives	12
c)	Thesis/Additional Courses	06
	Total	**30**

a) Core Courses

Course Title	Code	Cr. Hrs.
Advanced Algorithms Analysis	CSAC5613	3
Advanced Theory of Computation	CSSC5333	3
Advanced Computer Architecture	CSNS5523	3
Advanced Operating Systems	CSNS5513	3
Theory of Programming Languages	CSSC5343	3

b) Electives (12 Cr. Hrs.)

Following is a non-exhaustive list of elective courses. New elective courses may be added to this list. Students may be recommended to make their choice of electives, in the light of a soft specialization within the field of Computer science.

Course Title	Code	Cr. Hrs.
Topics in Artificial Intelligence	CSAC5643	3
Topics in Computer Vision	CSIP6163	3
Topics in Information Retrieval	CSDS7433	3
Advanced Topic in Information Retrieval	SCDS7443	3
Topics in Networks & Communication	CSNS6553	3
Topics in Embedded Systems	CSNS6543	3
Advanced Software Engineering	CSSE5013	3
Software Quality Assurance	CSSE5123	3
Requirements Engineering	CSSE5033	3
Formal Methods	CSSE5043	3
Formal Specification and Design Techniques	CSSE5053	3
Digital Image Processing	CSIP5123	3
Digital Signal Processing	CSIP5113	3
Computational Intelligence	CSCI7233	3
Fuzzy Intelligence	CSCI5213	3
Machine Learning	CSCI5223	3
Advanced Topics in Computer Networks	CSNS6573	3
Parallel Computing	CSSC5313	3
Distributed Systems	CSSC5323	3
Theory of Programming Languages	CSSC5343	3
Advanced Database Systems	CSDS5413	3
Big Data Analytics	CSDS5473	3

Course Title	Code	Cr. Hrs.
Data Mining	CSDS5423	3
Research Trends in Cyber Security	CSNS6583	3
Data Warehousing	CSDS6443	3
Information Retrieval Techniques	CSDS5443	3
Mobile Communication Systems	CSNS5533	3
Network Security	CSNC5423	3
Reinforcement Learning	CSCI5243	3
Convex Optimization	CSCI5233	3
Multimedia Systems	CSSE5533	3
Algorithmic Graph Theory	CSAC5623	3
Software Project Management	CSSE6063	3
Computer Vision	CSIP6133	3
Robotics	CSIP6143	3
Pattern Recognition	CSCI6243	3
Mobile Robotics	CSST5693	3
Fuzzy Automata and Languages	CSSC6353	3
Advanced Compiler Techniques	CSSC6363	3
Applied Image Processing	CSIP6123	3

Course Title	Code	Cr. Hrs.
Advanced Data Mining	CSDS6453	3
Emerging Trends in Information Retrieval	CSDS5493	3
Multimedia Database Systems	CSDS6463	3
Advanced Computer Networks	CSNS6563	3
Systems Modeling and Simulation	CSAC6633	3
Dynamic Modeling and Algorithms	CSAC6643	3
Operations Research-I	CSSC6373	3
Natural Language Processing	CSCI6233	3
Stochastic Processes	CSAC6653	3
Advanced Topics in Software Engineering	CSSE7013	3
Genetic Algorithms	CSAC6663	3
Operations Research-II	CSSC7383	3
Computer Aided Interpolation & Designing	CSAC6623	3
Distributed Knowledge Engineering	CSCI7253	3
Advanced Topics in Formal Methods	CSSE5063	3
Special Topics in Computational Intelligence	CSCI7213	3
Real Time Systems	CSNS7573	3

Course Title	Code	Cr. Hrs.
Advanced Data Mining	CSDS6453	3
Emerging Trends in Information Retrieval	CSDS5493	3
Multimedia Database Systems	CSDS6463	3
Advanced Computer Networks	CSNS6563	3
Systems Modeling and Simulation	CSAC6633	3
Dynamic Modeling and Algorithms	CSAC6643	3
Operations Research-I	CSSC6373	3
Natural Language Processing	CSCI6233	3
Stochastic Processes	CSAC6653	3
Advanced Topics in Software Engineering	CSSE7013	3
Genetic Algorithms	CSAC6663	3
Operations Research-II	CSSC7383	3
Computer Aided Interpolation & Designing	CSAC6623	3
Distributed Knowledge Engineering	CSCI7253	3
Advanced Topics in Formal Methods	CSSE5063	3
Special Topics in Computational Intelligence	CSCI7213	3
Real Time Systems	CSNS7573	3
Wireless Networks	CSNS7583	3
Geometric Modelling for Curve Designing	CSAC6673	3
Biomedical Signal and Image Processing	CSIP6153	3
Topics in Statistical Natural Language Processing	CSCI6253	3
Information Retrieval and Web Search Engine	CSDS5483	3
Design of Interactive Learning Applications	CSSE7023	3
Mobile Robotics	CSST5693	3
Research Methodology	CSST5663	3

b) Research Thesis

Course Title	Code	Cr. Hrs.
Research Thesis	CSRW6916	3
Thesis Continuation	CSRW6921	3

1.3 Program Duration

This is nominally a two-year degree program comprising 4 semesters with a minimum of 30 Cr. Hrs. There will be a Fall and a Spring semester each year. The summer semester will be utilized for deficiency courses. The maximum duration to complete an MS Computer Science degree is 04 years.

MS
Data Science

1.1 Admission Requirements

(i) A minimum of 16 years of education leading to BS in Computer Science/ Information Technology/Software Engineering or equivalent

(ii) Pre-requisite courses will be determined as per HEC policy (if any)

(iii) Minimum 2.00/4.00 CGPA or 50% marks from an annual system

(iv) All applicants are required to pass UCP Admission Test and interview

1.2 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) Course work only (10 Courses)

Each candidate for the MS Data Science degree is required to successfully earn 30 Cr. Hrs. with the CGPA of 2.50 on the scale of 4.00 as per the following detail:

	Area	Cr. Hrs.
a)	Core Courses	12
b)	Specialization	12
c)	Electives	06
d)	Thesis/Additional Courses	
	Total	**30**

a) Core Courses

Course Title	Code	Cr. Hrs.
Statistical and Mathematical Methods for Data Science	DSSM5103	3
Tools and Techniques in Data Science	DSDS5203	3
Machine Learning	DSAI5303	3
Research Methodology	DSRM5401	3

b) Specialization Courses

Select any 02 courses out of following:

Course Title	Code	Cr. Hrs.
Big Data Analytics	DSDS5213	3
Deep Learning	DSAI6323	3
Natural Language Processing	DSA16323	3
Distributed Data Processing	DSDS6233	3

c) Electives

Following is a non-exhaustive list of elective courses. New elective courses may be added to this list. Students may be recommended to make their choice of electives, in the light of a soft specialization within the field of data science.

Course Title	Code	Cr. Hrs.
Topics in Artificial Intelligence	DSAI5643	3
Topics in Data Visualization	DSIP6163	3
Topics in Data & Information Retrieval	DSDS7433	3
Topics in Networks & Communication	DSNS6553	3
Topics in Cloud Computing Technologies	DSNS6543	3
Advanced Computer Vision	DSIP5603	3
Algorithmic Trading	DSCS5503	3
Bayesian Data Analysis	DSDS5233	3
Big Data Analytics	DSDS5243	3
Bioinformatics	DSCS5513	3
Cloud Computing	DSCS5523	3
Computational Genomics	DSSM6153	3
Data Visualization	DSDS6253	3
Deep Reinforcement Learning	DSAI6333	3

Course Title	Code	Cr. Hrs.
Distributed Data Processing and Machine Learning	DSDS6263	3
Distributed Machine Learning in Apache Spark	DSAI6343	3
High Performance Computing	DSCS5533	3
Inference & Representation	DSDS6273	3
Optimization Methods for Data Science and Machine Learning	DSSM5113	3

d) Research Thesis

Course Title	Code	Cr. Hrs.
Research Thesis	DSRW6916	6
Thesis Continuation	DSRW6921	1

2.3 Program Duration

This is a two-year degree program comprising 4 semesters with 30 Cr. Hrs. There will be a Fall and a Spring semester each year. The summer semester will be utilized for deficiency courses. The maximum duration to complete MS Data Science degree is 04 years.

PhD
Computer Science

The Department provides a vibrant and dynamic environment that encourages excellence in research specifically in the areas of Software Systems & Engineering, Multimedia & Communications, Web and Information Systems and Computational Business Intelligence. The PhD program aims at producing graduates who could meet the challenges of emerging international trends in Computer Science. To achieve this objective, we have a team of highly qualified and dedicated faculty members and a cohesive and carefully designed PhD program. A due emphasis has been placed on the applied and industrial aspects of the research. For this purpose, the Department has established a strong liaison with Research & Development organizations and industry.

1.1 Admission Requirements

(i) MS degree in relevant discipline

(ii) Minimum CGPA 3.00/4.00 (Semester System) or 60% marks (Annual System)

(iii) All applicants are required to pass UCP Admission Test and interview

1.2 Degree Requirements

A PhD candidate shall be awarded a degree on successful completion of the following requirements:

(i) 18 Cr. Hrs. Course Work with minimum CGPA 3.00/4.00

(ii) Comprehensive Examination (written and oral)

(iii) 30 Cr. Hrs. Research Work

(iv) Synopsis Defense

(vi) Publication of at least one research paper in HEC approved journal.

(vii) Dissertation Final Defense

Note: PhD scholars are required to comply with the following timeline:

Activity	Preferred Time	Maximum
Course Work	2 Semesters	3 Semesters
Comprehensive Exam	3 Semesters	4 Semesters
Synopsis Qualification	4 Semesters	6 Semesters
Thesis Submission	6 Semesters	14 Semesters (7 Years)

BS Software Engineering

1.1 Admission Requirements

(i) At least 50% marks in Intermediate (F.Sc. Pre-Engineering/ICS/Pre-Medical/A Levels examination with Mathematics or equivalent qualification certified by IBCC.

(ii) Applicant will clear UCP test or equivalent.

1.2 Degree Requirements

Each candidate for the BS Software Engineering degree is required to successfully earn 133 Cr. Hrs. with the minimum CGPA of 2.0 on the scale of 4.0 as per the following detail:

	Area	Cr. Hrs.
a)	Core Courses	61
b)	Math Science Foundation Courses**	12
c)	Humanities Courses	18
d)	Supporting Courses	09
e)	SE Elective Courses	15
f)	University Elective Courses	12
g)	Design Project	06
	Total	**133**

Note**: Pre-Medical students have to pass 2 additional mathematics deficiency courses of 6 credit hours within one year of their regular bachelor studies.

a) Core Courses (61 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Introduction to Computing	SECP1013	3
Introduction to Computing Lab	SECP1011	1
Programming Fundamentals	SECP1023	3
Programming Fundamentals Lab	SECP1021	1
Object Oriented Programming	SECP2033	3
Object Oriented Programming Lab	SECP2031	1
Data Structures and Algorithms	SECP2043	3
Data Structures and Algorithms Lab	SECP2041	1
Discrete Structures	SEAD1413	3
Introduction to Database Systems	SEAD3423	3
Introduction to Database Systems Lab	SEAD3421	1
Operating Systems	SENS3513	3
Operating Systems Lab	SENS3511	1
Software Engineering	SESE1113	3
Computer Communications and Networks	SENS3523	3
Computer Communications and Networks Lab	SENS3521	1
Information Security	SENS4533	3
Human Computer Interaction	SESE2123	3
Software Requirements Engineering	SESD2213	3
Software Design & Architecture	SESD2222	2
Software Design & Architecture Lab	SESD2221	1
Software Construction & Development	SESD3242	2
Software Construction & Development Lab	SESD3241	1
Software Quality Engineering	SESM3313	3
Software Project Management	SESM4323	3
Software Re-engineering	SESE4143	3
Web Engineering	SESD3233	3

b) Math Science Foundation Courses (12 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Calculus and Analytical Geometry	SESS1713	3
Basic Electronics	SESS1723	3
Linear Algebra	SESS2743	3
Probability and Statistics	SESS2733	3
Pre-Calculus (Only for Pre-Medical)	SESS1773	3
Elementary Algebra (Only for Pre-Medical)	SESS1783	3

c) Humanities Courses (18 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
English Composition & Comprehension	SEHU1833	3
Pakistan Studies	SEHU1813	2
Islamic and Religious Studies	SEHU1823	2
Communication & Presentation Skills	SEHU1863	3
Technical and Business Writing	SEHU2873	3
Professional Practices	SEGE3953	3
Career Lab	CSO3001	1
Fundamentals of Entrepreneurship	ENT101	1

d) Supporting Courses (09 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Supporting I	SEZZzzz3	3
Supporting II	SEZZzzz3	3
Supporting III	SEZZzzz3	3

Any 03 of the following courses.

Course Title	Code	Cr. Hrs.
Business Process Engineering	SEST2613	3
Formal Methods in Software Engineering	SESE3133	3
Operations Research	SESS3763	3
Simulation and Modeling	SESD4263	3
Stochastic Processes	SESS3753	3

e) Software Engineering Elective Courses (15 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
SE Elective I	SEZZzzz3	3
SE Elective II	SEZZzzz3	3
SE Elective III	SEZZzzz3	3
SE Elective IV	SEZZzzz3	3
SE Elective V	SEZZzzz3	3

(List of University Electives Courses)

Following list is non-exhaustive.

Course Title	Code	Cr. Hrs.
Introduction to Psychology	SEHU1843	3
Foreign Language	SEHU1853	3
Introduction to Business	SEGE1913	3
Introduction to Game Production	SEGE2923	3
Technical Entrepreneurship	SEGE2933	3
Creative Graphics	SEGE3943	3
Fundamentals of Marketing	SEGE3963	3
Enterprise Resource Planning	SEGE3993	3
Human Resource Management	SEGE1923	3

g) Design Project (06 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.
Final Year Project I	SESD4913	3
Final Year Project II	SESD4923	3

1.3 Community Service (SE4000)

Each student is required to complete 65 hours' community work, usually after 4th semester which would be a prerequisite to clear the student for the award of degree.

1.4 Program Duration

This is a four-year degree program comprising 8 semesters with a minimum of 133 Cr. Hrs. There will be a Fall and a Spring semester each year. The summer semester will be utilized for internship or deficiency courses. The minimum and maximum duration to complete BS Software Engineering degree is 04 and 07 years, respectively.

Scheme of Studies

BS Software Engineering Program

Semester-I (19 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	SECP1013	Introduction to Computing	3	Core
2.	SECP1011	Introduction to Computing – LAB	1	Core
3.	SESS1723	Basic Electronics	3	Math Science
4.	SEZZzzz3	University Elective – I	3	Uni Elective
5.	ENG101	English I	3	Humanities
6.	PAK101	Pakistan Studies	2	Humanities
7.	ENT101	Fundamentals of Entrepreneurship	1	Humanities
8.	SESS1773	Pre-Calculus[1]	3	Math Science

Semester-II (19 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	SECP1023	Programming Fundamentals	3	Core
2.	SECP1021	Programming Fundamentals – Lab	1	Core
3.	SESE1113	Software Engineering	3	Core
4.	ENG102	Communication & Presentation Skills	3	Humanities
5.	SEAD1413	Discrete Structure	3	Core
6.	SESS1713	Calculus and Analytical Geometry	3	Math Science
7.	SESS1783	Elementary Algebra[2]	3	Math Science

Semester-III (16 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	SECP2033	Object Oriented Programming	3	Core
2.	SECP2031	Object Oriented Programming – Lab	1	Core
3.	SEAD3423	Introduction to Database Systems	3	Core
4.	SEAD3421	Introduction to Database Systems – Lab	1	Core
5.	SESD2213	Software Requirement Engineering	3	Core
6.	SESS2743	Linear Algebra	3	Math Science
7.	SEZZzzz3	Islamic Studies	2	Humanities

[1] Only for Pre-Medical Students
[2] Only for Pre-Medical Students

Semester-IV (16 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	SECP2043	Data Structure & Algorithms	3	Core
2.	SECP2041	Data Structure & Algorithms – Lab	1	Core
3.	SESD2222	Software Design & Architecture	2	Core
4.	SESD2221	Software Design & Architecture – Lab	1	Core
5.	SESD3233	Web Engineering	3	Core
6.	SEHU2873	Technical & Business Writing	3	Humanities
7.	SESS2733	Probability & Statistics	3	Math Science

Semester-V (16 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	SENS3513	Operating Systems	3	Core
2.	SENS3511	Operating Systems – Lab	1	Core
3.	SESE2123	Human Computer Interaction	3	Core
4.	CSO3001	Career Lab	1	Humanities
5.	SEZZzzz3	SE Elective – I	3	SE Elective
6.	SEZZzzz3	University Elective – II	3	Uni Elective
7.	SEZZzzz3	SE Supporting	3	Supporting

Semester-VI (16 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	SENS3523	Computer Comm. and Networks	3	Core
2.	SENS3521	Computer Comm. and Networks – Lab	1	Core
3.	SESD3242	Software Construction and Development	2	Core
4.	SESD3241	Software Construction and Development – Lab	1	Core
5.	SEZZzzz3	SE Elective – II	3	SE Elective
6.	SEZZzzz3	SE Elective – III	3	SE Elective
7.	SEZZzzz3	SE Supporting – II	3	Supporting

Semester-VII (18 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	SENS4533	Information Security	3	Core
2.	SESM4323	Software Project Management	3	Core
3.	SESE4143	Software Re-engineering	3	Core
4.	SEZZzzz3	SE Elective – IV	3	SE Elective
5.	SEZZzzz3	SE Elective – V	3	SE Elective
6.	SESD4913	Final Year Project I	3	Core

Semester-VIII (18 Cr. Hrs.)

S. No	Course Code	Course Title	Cr. Hrs.	Type
1.	SEZZzzz3	University Elective III	3	Uni Elective
2.	SEZZzzz3	University Elective IV	3	Uni Elective
3.	SEGE3953	Professional Practices	3	Humanities
4.	SESM3313	Software Quality Engineering	3	Core
5.	SEZZzzz3	Supporting – III	3	Supporting
6.	SESD4923	Final Year Project II	3	Core

BS

BS Cyber Security

1. Admission Requirements

I. At least 50% marks in Intermediate (HSSC) examination with Mathematics or equivalent qualification with Mathematics certified by IBCC.

II. At least 50% marks in Intermediate Pre-medical (subject combination of Physics, Chemistry and Biology) are also eligible to apply. Such candidates, if admitted, are required to study additional two Mathematics courses, worth 6 credit hours, during the first year of studies at the institution.

III. Applicant will clear UCP test or equivalent.

2. Degree Requirements

Each candidate for the **BS Cyber Security** degree is required to successfully earn 132 Cr. Hrs. with the minimum CGPA of 2.0 on the scale of 4.0 as per the following detail:

Areas	Courses	Cr. Hrs.
Computing Core	14	47
Domain Core	6	18
Domain Elective	7	21
Mathematics & Supporting Courses**	4	12
Elective Supporting Courses	1	3
General Education Requirements	12	31
Total	**44**	**132**

** Pre-Medical students have to pass 2 additional mathematics deficiency courses of 6 credit hours within one year of their regular bachelor studies

2.1. Computing Core Courses (14 Courses) (47 Cr. Hrs.)

#	Course Title	Code	Cr. Hrs.
	COMPUTING CORE		
1	Programming Fundamentals	CP113	3
	Programming Fundamentals Lab	CP111	1
2	Object Oriented Programming	CP223	3
	Object Oriented Programming Lab	CP221	1
3	Data Structures	CP233	3
	Data Structures Lab	CP231	1
4	Database Systems	DB203	3
	Database Systems Lab	DB201	1
5	Operating Systems	AR332	2
	Operating Systems Lab	AR331	1
6	Software Engineering	SE203	3
7	Computer Networks	NS302	2
	Computer Networks Lab	NS301	1
8	Information Security	NS312	2
	Information Security Lab	NS311	1
9	Analysis of Algorithm	AL303	3
10	Digital Logic Design	AR102	2
	Digital Logic Design Lab	AR101	1
11	Artificial Intelligence	AL312	2
	Artificial Intelligence Lab	AL311	1
12	Computer Organization & Assembly Language	AR223	3
	Computer Organization & Assembly Language Lab	AR221	1
13	Final Year Project I	CP483	3
14	Final Year Project II	CP493	3

2.2. Domain Core Courses (18 Cr. Hrs.)

#	Course Title	Code	Cr. Hrs.
1	Cyber Security	NS342	2
	Cyber Security Lab	NS341	1
2	Information Assurance	CY312	2
	Information Assurance Lab	CY311	1
3	Secure Software Design and Development	SD342	2
	Secure Software Design and Development Lab	SD341	1
4	Parallel & Distributed Computing	CP442	2
	Parallel & Distributed Computing Lab	CP441	1
5	Network Security	NS422	2
	Network Security Lab	NS441	1
6	Digital Forensic	CY412	2
	Digital Forensic Lab	CY411	1

2.3. Cyber Security Elective Courses (21 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
CyberSec Elective I		3
CyberSec Elective II		3
CyberSec Elective III		3
CyberSec Elective IV		3
CyberSec Elective V		3
CyberSec Elective VI		3
CyberSec Elective VII		3

List of Elective Courses: Following is a list of elective courses. New elective courses may be added to this list. Students may be recommended to make their choice of electives, in the light of a soft specialization.

#	Course Title	Code	Cr. Hrs.
1	Security Architecture and Design	CY493	3
2	Ethical Hacking	CY363	3
3	Cloud Security	NS353	3
4	Cybersecurity Policy and Governance	SEP343	3
5	IoT Security	NS363	3
6	Cybersecurity Analytics and Big Data	CY423	3
7	Wireless and Mobile Security	CY353	3
8	Malware Analysis	CY343	3
9	Information System Security	CY323	3
10	Cyber Law & Cyber Crime (Cyber Warfare)	CY373	3
11	Cryptanalysis	CY393	3
12	Control System Security	CY453	3
13	Speech Processing	ML443	3
14	Machine Learning	ML302	2
	Machine Learning Lab	ML301	1
15	Cloud Computing	DB323	3

2.4. Mathematics & Supporting Courses (12 Cr. Hrs.)

#	Course Title	Code	Cr. Hrs.
1	Multivariable Calculus	MAT243	3
2	Linear Algebra	MAT233	3
3	Probability and Statistics	MAT253	3
4	Technical and Business Writing	ENG203	3
5*	Pre-Calculus (Only for Pre-Medical)	MAT103	3
6*	Elementary Algebra (Only for Pre-Medical)	MAT123	3

2.5. Elective Supporting Courses (3 Cr. Hrs)

#	Course Title	Code	Cr. Hrs.
1	Social Science		3

2.6. General Education Courses (31 Cr. Hrs.)

#	Course Title	Cr. Hrs.
1	Application of Information & Communication Technologies	4
2	Functional English	3
3	Expository Writing	3
4	Quantitative Reasoning – I	3
5	Quantitative Reasoning – II	3
6	Islamic Studies	2
7	Ideology and Constitution of Pakistan	2
8	Social Sciences	2
9	Natural Sciences	3
10	Arts & Humanities	2
11	Civics and Community Engagement	2
12	Entrepreneurship	2

List of General Education Courses: Following is a list of general education courses. New courses may be added to this list.

#	Course Title	Code	Cr. Hrs.
1	Introduction to Computing	CP103	3
	Introduction to Computing Lab	CP101	1
2	Calculus and Analytical Geometry	MAT113	3
3	Discrete Structures	AL143	3
4	English Composition & Comprehension (Functional English)	ENG101	3
5	Communication & Presentation Skills (Expository Writing)	ENG102	3
6	Pakistan Studies	PAK101	2
7	Islamic Studies	ISL201	2
8	Professional Practices	SEP203	2
9	Basic Electronics	GE102	2
	Basic Electronics Lab	GE1021	1
10	Civics and Community Engagement	SEP113	2
11	Ideology and Constitution of Pakistan	PAK102	2
12	Introduction to Psychology	PSY101	3
13	Foreign Language		3
14	Introduction to Business		3
15	Entrepreneurship		3
16	Creative Graphics		2
17	Fundamentals of Marketing		3
18	Enterprise Resource Planning		3
19	Human Resource Management		3
20	Financial Accounting		3

2.7. Others (1 Cr. Hr.)

As per university requirements, 1 extra course of Career Lab will be offered in 4th year of studies.

3. Design Project (06 Cr. Hrs.)

After the completion of 90 Cr. Hr., the students are required to demonstrate their practical skills in the field of Cyber Security by designing and implementing a project worth of 06 Cr. Hrs. The project shall be completed in two parts as given below:

Course Title	Code	Cr. Hrs.
Final Year Project I	CP483	3
Final Year Project II	CP493	3

4. Community Service

Each student is required to complete 65 hours community work usually after 4th semester which would be prerequisite to clear the student for the award of degree.

5. Program Duration

This is a four-year degree program comprising of 08 semesters with a minimum of 132 Cr. Hrs. There will be Fall and Spring semesters each year. The summer semester will be utilized for internship of deficiency courses. The minimum and maximum duration to complete BS Cyber Security Program is 04 and 07 years respectively.

Bachelor of Science in Cyber Security (BS CyberSec) - Roadmap

Semester-I				
S. No	Course Code	Course	Domain	Cr. Hrs.
1	CP103	Introduction to Computing (GE-I)	GER	3
	CP101	Introduction to Computing - Lab (GE-I)	GER	1
2	ENG110	Functional English (GE-II)	GER	3
3	GE102	Basic Electronics (GE-III)	GER	2
	GE101	Basic Electronics - Lab (GE-III)	GER	1
4	PAK102	Ideology and Constitution of Pakistan (GE-IV)	GER	2
5	AL143	QR 1 (Discrete Structures) (GE-V)	GER	3
6	MAT103	Pre-Calculus	(Only for Pre-medical Students)	3
Total				**15 (18)**

Theory Credit Hours	13 (16)	Lab Credit Hours	2
Theory Contact Hours	13 (16)	Lab Contact Hours	6

Semester-II					
S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	CP113	ITC	Programming Fundamentals	Computing Core	3
	CP111	ITC	Programming Fundamentals - Lab	Computing Core	1
2	AR102		Digital Logic Design	Computing Core	2
	AR101		Digital Logic Design - Lab	Computing Core	1
3	MAT113		QR 2 (Calculus and Analytic Geometry) (GE-VI)	GER	3
4	ENG102	FE	Expository Writing (GE-VII)	GER	3
5	SEP113		Civics and Community Engagement (GE-VIII)	GER	2
6	MAT123		Elementary Algebra	(Only for Pre-medical Students)	3
Total					**15 (18)**

Theory Credit Hours	13 (16)	Lab Credit Hours	2
Theory Contact Hours	13 (16)	Lab Contact Hours	6

Semester-III					
S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	CP223	PF	Object Oriented Programming	Computing Core	3
	CP221	PF	Object Oriented Programming - Lab	Computing Core	1
2	AR223	DLD	Computer Organization & Assembly Language	Computing Core	3
	AR221	DLD	Computer Organization & Assembly Language - Lab	Computing Core	1
3	MAT253		Probability & Statistics	Maths	3
4	SEP203		Arts & Humanities (Professional Practices) (GE-IX)	GER	2
5	MAT243	CAG	Multivariable Calculus	Maths	3
6	ENT201		Entrepreneurship (GE-X)	GER	2
Total					**18**

Theory Credit Hours	16	Lab Credit Hours	2
Theory Contact Hours	16	Lab Contact Hours	6

Semester-IV					
S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	CP233	OOP	Data Structures	Computing Core	3
	CP231	OOP	Data Structures - Lab	Computing Core	1
2	DB203		Database Systems	Computing Core	3
	DB201		Database Systems - Lab	Computing Core	1
3			Social Sciences (GE-XI)	GER	2
4	NS312		Information Security	Computing Core	2
	NS311		Information Security - Lab	Computing Core	1
5	MAT233	CAG	Linear Algebra	Maths	3
6	ISL201		Islamic Studies (GE- XII)	GER	2
Total					**18**

Theory Credit Hours	15	Lab Credit Hours	3
Theory Contact Hours	15	Theory Contact Hours	9

Semester-V

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	AL312		Artificial Intelligence	Computing Core	2
	AL311		Artificial Intelligence - Lab	Computing Core	1
2	SE203		Software Engineering	Computing Core	3
3	NS342	IS	Domain Core 1 (Cyber Security)	Domain Core	2
	NS341	IS	Domain Core 1 (Cyber Security) - Lab	Domain Core	1
4	AR332		Operating Systems	Computing Core	2
	AR331		Operating Systems - Lab	Computing Core	1
5	ENG203	FE	Technical & Business Writing	EN	3
6			Domain Elective 1	Domain Elective	3
Total					**18**

Theory Credit Hours	15	Lab Credit Hours	3
Theory Contact Hours	15	Lab Contact Hours	9

Semester-VI

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	NS302		Computer Networks	Computing Core	2
	NS301		Computer Networks - Lab	Computing Core	1
2	AL303	DS	Analysis of Algorithms	Computing Core	3
3	CY312		Domain Core 2 (Information Assurance)	Domain Core	2
	CY311		Domain Core 2 (Information Assurance) - Lab		1
4			Domain Elective 2	Domain Elective	3
5	SD342	Cyber	Domain Core 3 (Secure Software Design and Development)	Domain Core	2
	SD341	Cyber	Domain Core 3 (Secure Software Design and Development) - Lab	Domain Core	1
6			Domain Elective 3	Domain Elective	3
Total					**18**

Theory Credit Hours	15	Lab Credit Hours	3
Theory Contact Hours	15	Lab Contact Hours	9

Semester-VII

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1			Domain Elective 4	Domain Elective	3
2	CP483		Final Year Project - I	Computing Core	3
3	NS422	Cyber	Domain Core 4 (Network Security)	Domain Core	2
	NS421	Cyber	Domain Core 4(Network Security) - Lab	Domain Core	1
4	CY412	Cyber	Domain Core 5 (Digital Forensic)	Domain Core	2
	CY411	Cyber	Domain Core 5 (Digital Forensic) - Lab	Domain Core	1
5			Domain Elective 5	Domain Elective	3
Total					**15**

Theory Credit Hours	10	Lab Credit Hours	5
Theory Contact Hours	10	Lab Contact Hours	15

Semester-VIII

S. No	Course Code	Pre-Req	Course	Domain	Cr. Hrs.
1	CP442	OOP, OS	Domain Core 6 (Parallel & Distributed Computing)	Domain Core	2
	CP441	OOP, OS	Domain Core 6 (Parallel & Distributed Computing) - Lab	Domain Core	1
2	CP493	FYP-I	Final Year Project - II	Computing Core	3
3			Domain Elective 6	Domain Elective	3
4			Domain Elective 7	Domain Elective	3
5			Elective Supporting Course	SS	3
Total					**15**

Theory Credit Hours	11	Lab Credit Hours	4
Theory Contact Hours	11	Lab Contact Hours	12

Note: A Domain Elective course can be with or without lab as per department's offering. However, it will be at least three credit hours.

MS Software Engineering

1.1 Admission Requirements

The admission requirements are as follows:

I. A minimum of 16 years of education leading to BS in Computer Science/ Information Technology/Software Engineering or equivalent

II. Pre-requisite courses will be determined as per HEC policy (if any). The University may recommend deficiency courses, after considering the educational background and knowledge of the candidate.

III. Minimum 2.00/4.00 CGPA or 50% marks

IV. Admission Test/HEC Approved Test or equivalent.

1.2 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. Must have studied and passed the 24 credit hours of courses from the prescribed course list and successfully completed 6 credit hours of Thesis.

II. Must have studied and passed the 24 credit hours of courses from the prescribed course list and successfully completed 6 credit hours of Project (allowed only under special circumstances with prior approval from the HOD Office).

III. Must have studied and passed the prescribed courses, totaling at least 30 credit hours (allowed only under special circumstances with prior approval from the HOD Office).

Each candidate for the MS Software Engineering degree is required to successfully earn 30 credit hours with the CGPA of 2.5 on a scale of 4.0 as per the following detail:

	Area	Cr. Hrs.
a)	Core Courses	9
b)	Domain Elective Courses	6
c)	General Elective Courses	9
d)	Thesis / Project	6
	Total	**30**

a) Core Courses (12 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Advanced Requirements Engineering	SESD5213	3
Advanced Software System Architecture	SESD5223	3
Software Testing and Quality Assurance	SESD6253	3
Research Methodology	SERM5403	3

b) Domain Elective Courses (06 Cr. Hrs.)

Following is a non-exhaustive list of domain elective courses. New elective courses may be added to this list.

Course Title	Code	Cr. Hrs.
Software Measurement and Metrics	SESM5313	3
Component Based Software Engineering	SESD6273	3
Advanced Formal Methods	SESE5133	3
Advanced Human-Computer Interaction	SESE5123	3
Agile Software Development Methods	SESD5263	3
Empirical Software Engineering	SESE5113	3
Advanced Software Project Management	SESM6323	3
Software Engineering Methods	SESE6143	3

c) General Elective Courses (any 02 Courses)

Following is a non-exhaustive list of elective courses. New elective courses may be added to this list. Students may be recommended to make their choice of electives, in the light of a soft specialization within the field.

Course Title	Code	Cr. Hrs.
Software Risk Management	SESM5343	3
Software Configuration Management	SESM5333	3
Reliability Engineering	SEST6653	3
Complex Networks	SENS5543	3
Agent Based Modeling	SEST5623	3
Machine Learning	SEAD5453	3
Artificial Intelligence	SEAD6433	3
Semantic Web	SEST5643	3
Big Data Analytics	SECP6073	3
Data Science	SEAD5443	3
Computer Vision	SEAD6493	3
Advanced Computer Networks	SENS6523	3
Cloud Computing	SEST5673	3
Software Verification and Testing	SESM5533	3
Advanced Image Processing	SEAD6483	3
Formal Specification and Design Techniques	SEST5683	3
Natural Language Processing	SEAD5463	3

d) Research Thesis / Project

Course Title	Code	Cr. Hrs.
Research Thesis	SERW6916	6
Thesis Continuation	SERW6921	6

1.3. Program Duration

This is a two-year degree program comprising 4 semesters with 30 Cr. Hrs. There will be a Fall and a Spring semester each year. The summer semester may be utilized for deficiency courses. **The maximum duration to complete MS Software Engineering degree is 04 years.**

Scheme of Studies

MS Software Engineering Program

Semester I (09 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Core Course – I	Core	3
Core Course – II	Core	3
Research Methodology (Core Course – III)	Core	3

Semester II (09 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Core Course – IV	Core	3
Elective – I	General Elective	3
Elective – II	Domain Elective	3

Semester III (06 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Elective – III	Domain Elective	3
MS Thesis – I / MS Project – I	Thesis / Project	3

Semester IV (06 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Elective – IV	General Elective	3
MS Thesis – II / MS Project – II	Thesis / Project	3

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