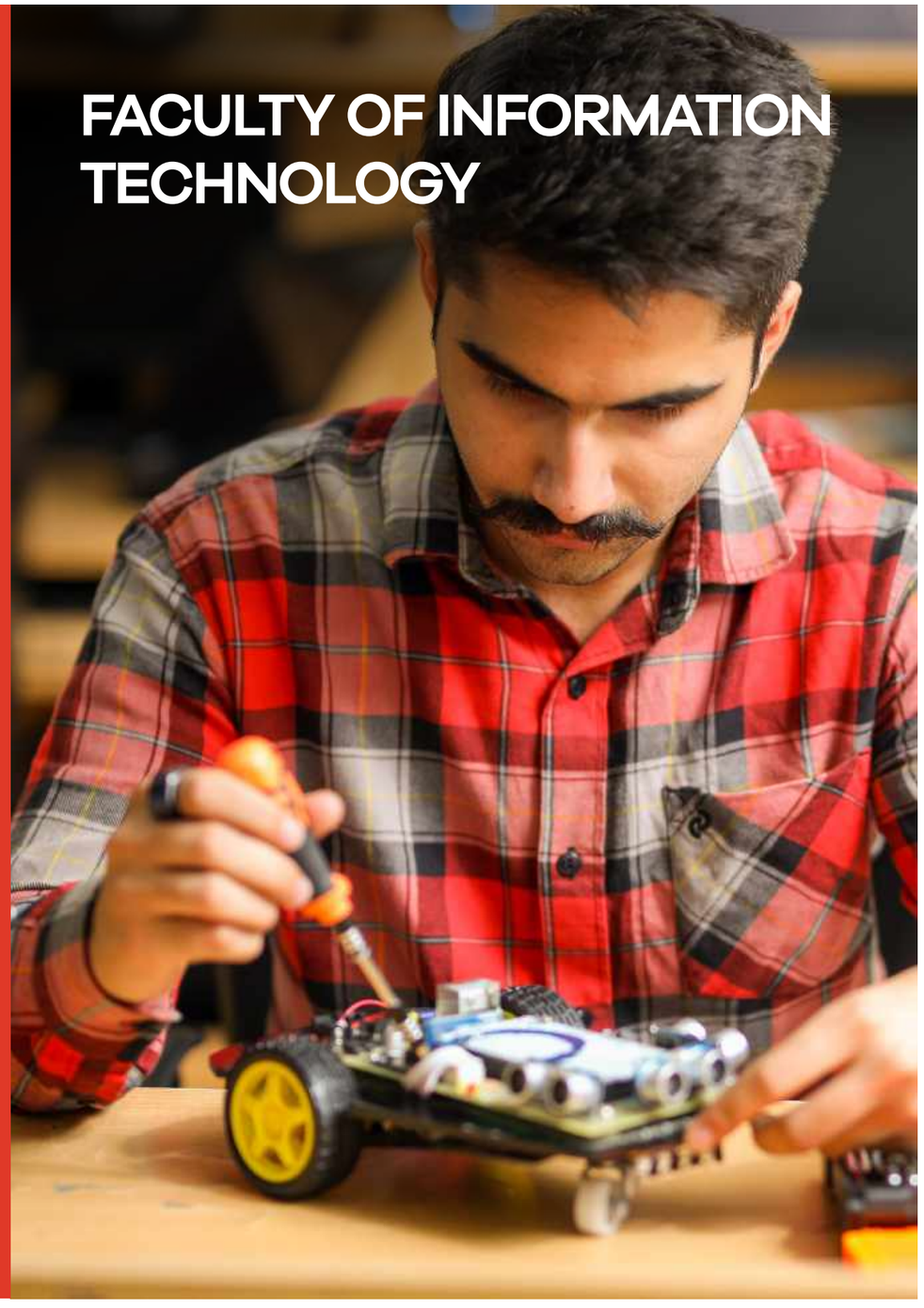


**UNIVERSITY OF
CENTRAL PUNJAB**

1 - Khayaban-e-Jinnah
Road, Johar Town, Lahore.

080-000-827 | UCP.EDU.PK

FACULTY OF INFORMATION TECHNOLOGY

CONTENTS

CAREER PROSPECTS

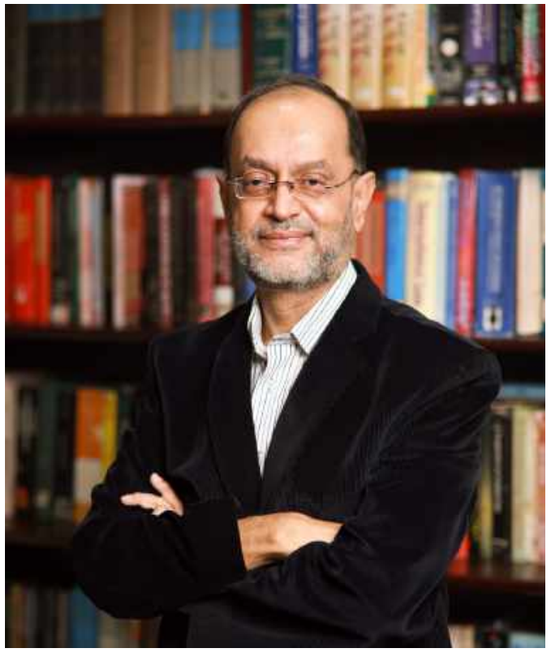
IT brings many exciting opportunities for students after the completion of their studies. This dynamic field offers an array of opportunities to our students, to see them excelling as Data Scientists, Data Analysts, Business Analysts, Computer Service Technicians, Cyber Security Specialists, Software Developers, etc. Each career opportunity requires a distinctive set of skills and personal traits; almost all IT jobs depend on strong technical knowledge, which Faculty of Information Technology at UCPs imparts in its students.

DEAN'S MESSAGE

We have made major strides from 2019 to 2020 - achieving significant improvements in the quality of teaching and increasing the breadth and inter-disciplinary nature of the research portfolio of the faculty. Our plans for the coming year are even more ambitious. Our existing research centres continue to mature while the groundwork for new ones is in process. All research activities at FOIT are geared to realize our primary mission: analyze and diagnose problems encountered in the real world, conduct research and develop innovative, independently verifiable solutions. We bring the perspectives and powerful techniques of Computer Science to bear Pakistan's particular socio-economic challenges, particularly in the fields of data science, game design, health care and campus security. In the process, we are further strengthening our linkages, both with the software industry and with the institutions of higher education in Pakistan and abroad.

These improvements translate into a new breed of Computer Science graduates, young women and men brimming over with energy, ambitious in their objectives, clear on the nature of the challenges facing society and quick to learn new concepts and technologies and thrive in challenging circumstances. Furthermore, we are striving to bring in guest speakers from the industry and develop a relationship with the industry experts, providing various opportunities for our students to learn about state-of-the-art, cutting edge technologies.

FOIT has consistently achieving significant improvements in the quality of both undergraduate and postgraduate education by introducing emerging technologies to increase the breadth and depth of taught courses and research. The efforts have been applauded by the professional industry and research



DR. M AHMAD SHABBIR KAZMI

communities, thus, encouraging us to plan even more ambitiously for the coming year. Our state-of-the-art research centres continue to mature while the groundwork for new ones is in process. The novel initiatives that are undertaken by the FOIT focus on addressing the issues specific to the socio-economic challenges and problems of Pakistan. We bring the perspectives and powerful techniques of Computer Science to the fields of data science, game design, learning design, health care, robotics and campus security. Our collaborations with national and international partners promise independently verifiable materialization of our vision to make Pakistan a leader in Computer Science and Software Development.

Our major source of strength is the competent, experienced and qualified faculty members at FOIT. All faculty members continuously engage themselves in efforts to provide a quality learning experience to the students. We are proud to have introduced an indigenously developed process to monitor students' progress on daily-basis and enabling teachers to respond effectively and efficiently to any learning difficulties faced by the students. These improvements, brought in through the untiring efforts of our team, envisage a new breed of computer science graduates; competent young women and men with a vision and full of purpose, to innovate and excel, to solve socio-economic problems of Pakistan, make significant contributions towards Pakistan's progress and prosperity. Furthermore, we at FOIT believe in contributing to the local communities and making a difference. We have been, with the help our students, conducting robotics workshops for local school students. This year FOIT is planning to offer workshops in Machine Learning, Robotics, Computer Vision and Image Processing, providing an opportunity for our students to contribute and make a difference in the education of our youth.

I am sure that our students will prove themselves in all challenging circumstances owing to the rigour and quality of education, a hallmark of FOIT. I invite you to join us on this fascinating and exciting journey, unlock your potential, a shrug of the conventional approaches, and boldly create new realities and new opportunities for the next generations.

ASSOCIATE DEAN'S MESSAGE

Faculty of Information Technology (FOIT) is one of the rapidly growing faculties at UCP. FOIT is offering programs in Computer Sciences, Software Engineering and Data Sciences at Undergraduate, Graduate and Postgraduate levels.

The Programs being offered by the Faculty are developed to fulfil the requirements of relevant standardization bodies like HEC and NCEAC while also meeting the industry needs. We are providing the best learning experience with state-of-the-art laboratories, classrooms and a conducive environment for imparting knowledge. We have highly qualified faculty members, including graduates from top-notch national and international institutes of Pakistan. Our well-qualified Faculty has specialized knowledge and skills in diversified disciplines hense, enabling our students to face world challenges and present innovative solutions.

We have been acquiring new knowledge by focusing on research both at graduate and post graduate level. We are researching Computer Science in a variety of domains like Medical Image Processing, Machine Learning, Networks & Communications, Embedded Systems & Robotics.

I welcome you all to be part of a vibrant and diversified Faculty of Information Technology to brighten up your future and open horizons of opportunities.

DR. MUHAMMAD AMJAD IQBAL

HEAD OF DEPARTMENT

DR. ADNAN N. QURESHI
DEPARTMENT OF
COMPUTER SCIENCE

DR. NAUMAN MAZHAR
DEPARTMENT OF
SOFTWARE ENGINEERING

OUR FACULTY

FACILITIES

Research Centres at the FOIT

The strength of FOIT is its highly qualified faculty – with specialized training in various fields of Computer Science from renowned universities of USA, Australia, UK, Sweden, France, Switzerland and Austria – dedicated to producing graduates and researchers with exceptional theoretical and practical skills in the field of Computer Science. The guidance and support extended by the faculty and administration during the entire learning experience of students has produced outstanding professionals, researchers and educators who are providing services in renowned national and international organizations.

Our well-equipped laboratories and state-of-the-art research facilities play a major role in the training and development of IT professionals. To facilitate the process of learning in both theoretical and experimental skills, we have project-based as well as general-purpose laboratories. To facilitate R&D activities, Faculty members and students are fully supported by research and development centres. To make a meaningful impact on the IT industry, academia, and local communities, the Faculty of IT has launched six centres. These research and development centres are conducting research and developing cutting-edge solutions with the potential to transform the growing field of IT. Productive research is in progress in the areas of Machine Learning, Data Analytics, Health Care, Robotics, Embedded Systems, Mathematics, Information Retrieval and Internet of Things. A brief description of these centres is as follows:

Centre for Learning & Design

By leveraging technology, we can transform the educational landscape of Pakistan and make education more effective, accessible and affordable for all students. With this vision, the Faculty of IT at UCP launched the Centre for Learning & Design in March 2016. The Centre aims to radically change the field of education and revolutionize the methods of imparting education with special attention paid to developing affordable educational tools and applications using mobile learning concepts for students from under-serviced communities. The Centre has been able to develope tools aiding in teaching the English language. Evaluation feedback is an important element in driving the learning methodologies. The classroom auto-response system is designed to facilitate early feedback to students for supporting classroom teaching and evaluation.

Centre for Game Design

The Faculty of IT at UCP has launched Pakistan's first game design centre to facilitate students who want to specialize in game design, especially in the EdTech space. This first of its kind centre is helping further to diversify the IT industry of Pakistan to enter the global game design market and building linkages amongst the computer game industry, computer scientists and instruction designers in academia. The primary focus of this Centre is on developing educational games and learning applications that provide an immerse experience where learners gain an intuitive understanding of critical building blocks in mathematics, kinematics and language learning. These solutions are currently being refined using feedback from the target user base - students, primarily in grades 6 through 8.
In addition to introducing game design programs at multiple levels of education, the Centre aims to conduct research and support entrepreneurs to promote the local game industry. It supports individuals who aspire to become entrepreneurs by providing them with various resources, mentorship and support in developing and marketing their products. The Centre provides the perfect platform for students from all disciplines to start their careers in the computer game industry.

Centre for Healthcare Modeling & Informatics

The Faculty of IT at UCP has initiated state-of-the-art informatics research for improving public health practices across many methodological disciplines, particularly Health Informatics, Bioinformatics, Biostatistics, Machine Learning, Computer Vision, Computer Science and Software Engineering. The focus of the research within the Centre is on the development of intelligent solutions at undergraduate, graduate and PhD levels to support evidence-based healthcare and to develop methodologies for utilizing information and communication technologies to improve the quality of healthcare.

The Centre, therefore, provides an E-infrastructure for health research by connecting a wide variety of investigators (clinical, public health and health services, computer scientists and engineers) with relevant analytical and modeling tools and large-scale aggregations of data, to establish broad-range medical applications.

Centre for Mathematics, Teaching and Research

Generally, one of the main challenges universities around the world face is poor learning achievement in mathematical courses. The Faculty recognizes this fundamental problem and has moved to address it with the establishment of the Centre for Mathematics Teaching and Research - the first of its type in our country. We believe that every student in Pakistan can learn mathematics - appreciate the beauty behind it and use it to solve daily life, as well as challenging problems. We find a general disconnect between abstract representations and the range of real-life scenarios that such representations apply to. This is a direct consequence of the prevalent attitude towards teaching and assessment with its focus on formulae, numerical accuracy and correct application of the prescribed method.

The Centre aims to re-introduce the sheer joy of learning in a new and incredibly powerful language.

Centre for Robotics

The Centre for Robotics focuses on solving real-life challenges and enabling students to sharpen their skills with hands-on experience. At the Centre, students experiment with both land-based and aerial robots. They develop machines with increasing levels of sophistication incorporating artificial intelligence that can play football or autonomously undertake inspection tasks in an agricultural field. The designing, modelling and controlling methods taught at the Centre, equip the students with the skill set to enter the industry with

confidence. Since its inception, the Centre has been developing autonomous robots and remotely operated machines to address a wide variety of challenges in agriculture. The Centre is also running DAAD (Deutscher Akademischer Austauschdienst) (German Academic Exchange Service) funded projects to automate agriculture, which is the backbone of the country. Visits by members of the Centre to collaborating European Research Institutes and vice versa are a regular feature of the Centre's work.

Societies

We strongly believe that co-curricular activities play an important role in the overall development of our students. To promote this culture, we encourage our students to join professional societies such as Institute of Electrical and Electronics Engineers (IEEE), Association for Computing Machinery (ACM) and Microsoft Student Partner (MSP). These platforms not only connect our students with computing professionals around the world but also serve to showcase their potential. FOIT has organized various seminars and workshops in collaboration with IEEE, ACM and MSP, including sessions on Windows 8 Programming, C#, ASP.net, Drupal CMS, wireless sensor networks, internet protocols and future challenges. In addition to this, gaming and programming competitions are also a regular feature of faculty activities.

Program Objectives

1. Complete projects using relevant information technologies

2. Develop and test business support and IT systems

3. Effectively collect, analyze and integrate multiple forms of information

4. Communication skills (written & oral) for project documentation and presentations

5. Project management skills for completion of projects with varying complexities/durations

6. Structured thinking and sound/logical judgments to achieve results

7. Effectively collaborate in multi-disciplinary teams for different projects

Programs Offered

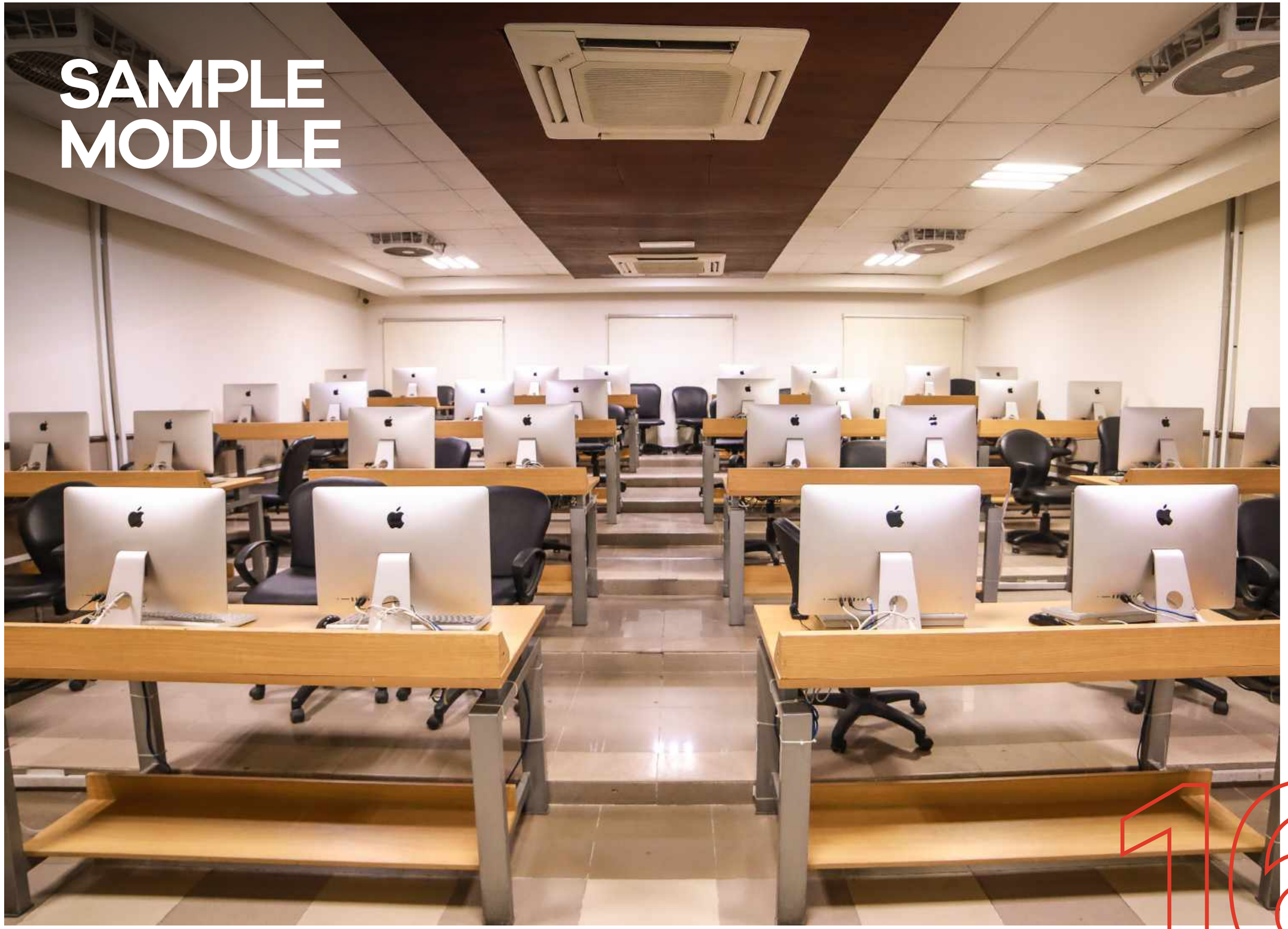
1. BS Computer Science

2. MS Computer Science

3. PhD Computer Science

4. BS Software Engineering

SAMPLE MODULE



DEPARTMENT OF COMPUTER SCIENCE

BS Computer Science

Admission Requirements

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

(ii) Applicant will clear UCP test or equivalent.

Degree Requirements

Each candidate for the BS Computer Science 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)	CS Elective Courses	15
f)	UCP Elective Courses	12
g)	Design Project	06
	Total	133

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
Discrete Structures	CSAL1213	3
Introduction to Database Systems	CSDB2313	3
Introduction to Database Systems Lab	CSDB2311	1
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
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

b) 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

c) Humanities Courses (18 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
English Composition & Comprehension	CSHU1823	3
Pakistan Studies	CSHU1893	3
Islamic and Religious Studies	CSHU1863	3
Communication & Presentation Skills	CSHU1873	3
Technical and Business Writing	CSHU2813	3
Professional Practices	CSMG4963	3

d) 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	CSAL4343	3

e) Computer Science Elective Courses (15 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
CS Elective I	CSXXxxx3	3
CS Elective II	CSXXxxx3	3
CS Elective III	CSXXxxx3	3
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.
Computational Geometry for Designing and Animation	CSAC3613	3
Advanced Machine Learning	CSAL4333	3
Advanced Mobile Development	CSCP3073	3
Advanced Database Systems	CSDS4413	3
Topics in Computer Science	CSAL3273	3
Computer Graphics	CSAL4273	3
Artificial Neural Networks	CSAL4283	3
Introduction to Speech Synthesis	CSAL4313	3
Mobile Application Development	CSCP3063	3
Introduction to Data Mining	CSDB3353	3
Fuzzy Data Mining	CSAL3263	3
3D Computer Graphics	CSAL4323	3
Applied Design Patterns	CSCP4063	3
Web Information Retrieval	CSDB4353	3

Course Title	Code	Cr. Hrs.
Introduction to Computational Linguistics	CSAL4233	3
Microprocessor and Interfacing	CSST3623	3
Database Administration	CSDB4333	3
Microprocessor Design	CSST3643	3
Microcontroller Programming and Interfacing	CSST3663	3
Introduction to Image Processing	CSAL3203	3
Decision Support Technologies	CSAL4213	3
Systems Analysis and Design	CSAL4223	3
Introduction to Natural Language Processing	CSAL4253	3
Object Oriented Analysis and Design	CSCP3023	3
Visual Programming	CSCP3043	3
Rapid Application Development	CSCP3053	3
System Programming	CSCP4073	3
Multimedia Arts	CSCP4083	3
Introduction to Computer Vision	CSDB3263	3
Data Analysis Techniques	CSDB3363	3
Introduction to Data Science	CSDB4313	3
Distributed Database Systems	CSDB4323	3
Database Administration	CSDB4333	3
Geographical Information System	CSDB4343	3
Programming for Big Data	CSDS4423	3
Data Warehousing	CSDS4433	3
Big Data Analytics	CSDS4473	3
Digital Signal Processing	CSIP3113	3
Data Network Security	CSNC3423	3
Data Communication	CSNC3433	3
Blockchain Essentials	CSNC3443	3
Introduction to Cloud Computing	CSNC3453	3
Formal Specification of Software	CSSE3123	3
Software Engineering II	CSSE3133	3
User Interface Design and Sketching	CSSE3153	3
Advanced Web Programming	CSSE3163	3
Software Quality Assurance	CSSE4123	3

Course Title	Code	Cr. Hrs.
Introduction to Agile and Scrum	CSSE4133	3
Application Development	CSSE4143	3
Web Engineering	CSSE4163	3
Software Testing	CSSE4193	3
Game Modeling	CSST3613	3
Introduction to Game Design	CSST3653	3
Visual Animation	CSST3673	3
FPGA Based System Design	CSST4613	3
Programming Game Engines	CSST4623	3
Technical Game Design	CSST4633	3
Game Algorithms	CSST4643	3
Interactive Multimedia	CSST4653	3
Advanced Game Development	CSST4663	3
Enterprise Resource Planning	CSST4673	3
Embedded System/Microcontroller Programming	CSST4683	3
Introduction to Robotics	CSST4693	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

List Of University Electives

Course Title	Code	Cr. Hrs.
Introduction to Psychology	CSHU1843	3
History of Pakistan	CSHU1853	3
Calligraphy	CSHU2823	3
Logic Thinking	CSHU2833	3
Geometry and Design	CSHU2843	3
Introduction to Sociology	CSHU2863	3
Modern Politics and Government	CSHU2883	3

Course Title	Code	Cr. Hrs.
Introduction to Chinese Language	CSHU3833	3
Introduction to Music	CSHU3843	3
Persian Language	CSHU3853	3
Foreign Language	CSHU3863	3
Speak Well - English Conversation	CSHU3873	3
Business Intelligence	CSHU4873	3
Business Mathematics	CSIM1113	3
Management Information System	CSIM3113	3
Principles of Marketing	CSIM3123	3
International Relations	CSMG1913	3
Financial Accounting	CSMG1923	3
Introduction to Business	CSMG1933	3
Business Ethics	CSMG1943	3
Technology Entrepreneurship	CSMG2913	3
Creative Graphics	CSMG2923	3
Introduction to Game Production	CSMG2933	3
The Aesthetic Approach	CSMG2943	3
Human Resource Management	CSMG3933	3
Organizational Behavior and Culture	CSMG3943	3
Fundamentals of Marketing	CSMG3953	3
Management Skills	CSMG3963	3
Urdu Literature	CSMG3973	3
Cultural Anthropology	CSMG3983	3
Iqbaliat	CSMG4923	3
Quranic Arabic	CSMG4933	3
Research Methodology	CSMG4973	3
Entrepreneurship	CSMG4983	3
Introduction to Management	CSMG4993	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	CSSD4913	3
Final Year Project II	CSSD4923	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 4-year degree program comprising of 8 semesters with a minimum of 133 Cr. Hrs. There will be a Fall and a Spring semester in each year. The summer semester will be utilized for internship or deficiency courses. The minimum and maximum duration to complete BS Computer Science degree is 4 and 7-years, respectively.

Scheme of Studies: BS Computer Science Program

Semester-I (16 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
CSCS1513	Introduction to Computing	Core	3
CSCS1511	Introduction to Computing Lab	Core	1
CSHU2833	Logic Thinking (UCP Elective I)	Uni Elective	3
CSHU1823	English Composition & Comprehension	Humanities	3
CSSS1723	Basic Electronics	Math Science	3
CSHU1863	Islamic and Religious Studies	Humanities	3

Semester-II (17 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
CSCP1013	Programming Fundamentals	Core	3
CSCP1011	Programming Fundamentals Lab	Core	1
CSCS2523	Digital Logic Design	Core	3
CSCS2521	Digital Logic Design Lab	Core	1
CSSS1713	Calculus and Analytical Geometry	Math Science	3
CSHU1873	Communication & Presentation Skills	Humanities	3
CSHU1893	Pakistan Studies	Humanities	3

Scheme of Studies: BS Computer Science Program

Semester-III (17 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
CSCP2023	Object Oriented Programming	Core	3
CSCP2021	Object Oriented Programming Lab	Core	1
CSCS3543	Computer Org. & Assembly Lang.	Core	3
CSCS3541	Computer Org. & Assembly Lang. Lab	Core	1
CSXXxxx3	Supporting I	Supporting	3
CSAL1213	Discrete Structures	Core	3
CSXXxxx3	UCP Elective II	Uni Elective	3

Semester-IV (17 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
CSSS2743	Probability and Statistics	Math Science	3
CSCP2033	Data Structures and Algorithms	Core	3
CSCP2031	Data Structures and Algorithms Lab	Core	1
CSDB2313	Introduction to Database Systems	Core	3
CSDB2311	Introduction to Database Systems Lab	Core	1
CSSS2753	Linear Algebra	General Science	3
CSXXxxx3	CS Elective I	CS Elective	3

Scheme of Studies: BS Computer Science Program

Semester-V (16 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
CSSE3113	Software Engineering	Core	3
CSCS3553	Operating Systems	Core	3
CSCS3551	Operating Systems Lab	Core	1
CSXXxxx3	Supporting II	Supporting	3
CSXXxxx3	CS Elective II	CS Elective	3
CSAL3233	Design and Analysis of Algorithms	Core	3

Semester-VI (17 Cr. Hrs.)

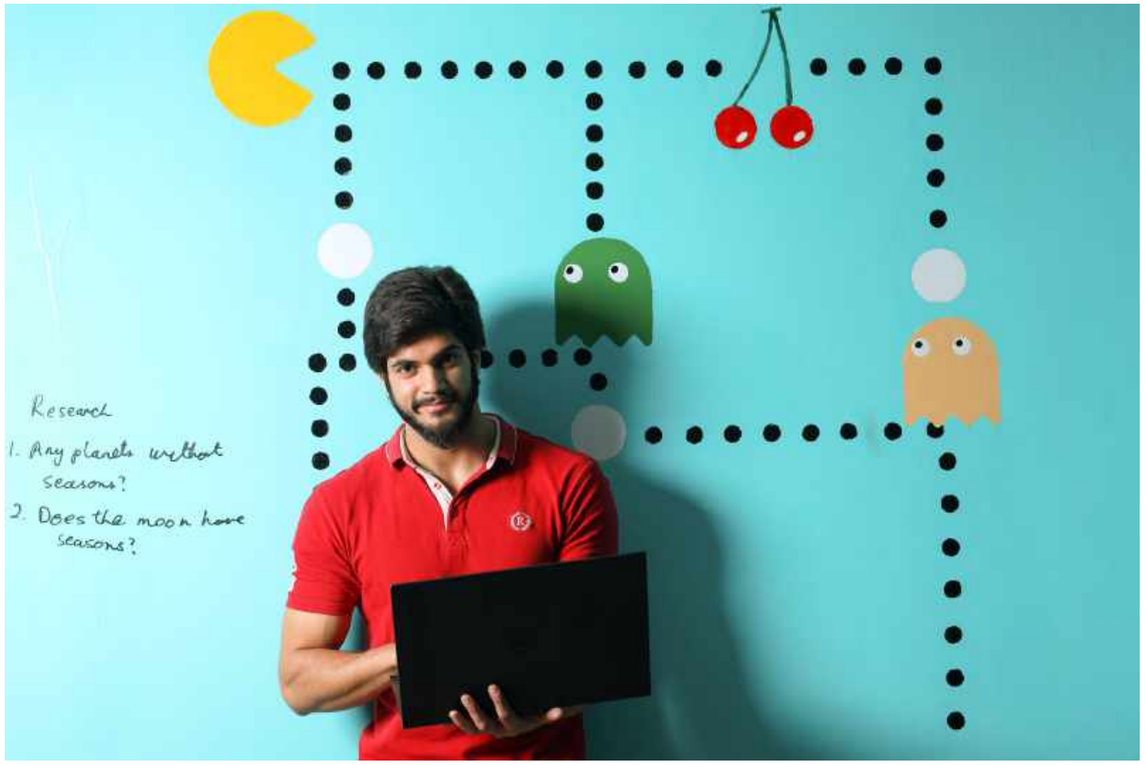
Course Code	Course Title	Category	Cr. Hrs.
CSAL3253	Theory of Automata	Core	3
CSAL3243	Artificial Intelligence	Core	3
CSAL3241	Artificial Intelligence Lab	Core	1
CSNC2413	Computer Comm. and Networks	Core	3
CSNC2411	Computer Comm. and Networks Lab	Core	1
CSXXxxx3	CS Elective III	CS Elective	3
CSHU2813	Technical and Business Writing	Humanities	3

Semester-VII (18 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
CSCS4573	Compiler Construction	Core	3
CSNC3413	Information Security	Core	3
CSXXxxx3	Supporting III	Supporting	3
CSXXxxx3	UCP Elective III	Uni Elective	3
CSXXxxx3	CS Elective IV	CS Elective	3
CSSD4913	Final Year Project I	Core	3

Semester-VIII (15 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
CSCS2543	Parallel and Distributed Computing	Core	3
CSMG4963	Professional Practices	Humanities	3
CSXXxxx3	CS Elective V	CS Elective	3
CSXXxxx3	UCP Elective IV	Uni Elective	3
CSSD4923	Final Year Project II	Core	3



BS DATA SCIENCE

Admission Requirements

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

(ii) Applicant will clear UCP test or equivalent.

Degree Requirements

Each candidate for the BS Data Science degree is required to successfully earn 133 Cr. Hrs. with the CGPA of 2.0 on a 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)	DS Elective Courses	15
f)	UCP Elective Courses	12
g)	Design Project	06
	Total	133

a) Core Courses (61 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Introduction to Computing	DSCP1013	3
Introduction to Computing Lab	DSCP1011	1
Programming Fundamentals	DSCP1023	3
Programming Fundamentals Lab	DSCP1021	1
Object Oriented Programming	DSCP2033	3
Object Oriented Programming Lab	DSCP2031	1
Data Structures & Algorithms	DSCP2043	3
Data Structures & Algorithms Lab	DSCP2041	3
Discrete Structures	DSAL2513	1
Operating Systems	DSNS3413	3
Operating Systems Lab	DSNS3411	1
Database Systems	DSDB2313	3
Database Systems Lab	DSDB2311	1
Software Engineering	DSSD3213	3
Computer Networks	DSNS3423	3
Computer Networks Lab	DSNS3421	1
Information Security	DSNS4433	3
Fundamentals of Data Science	DSDS1113	3
Big Data Programming	DSDS2123	3
Big Data Programming Lab	DSDS2121	1
Data Mining	DSDB3333	3
Data Mining Lab	DSDB3331	1
Artificial Intelligence	DSAL3533	3
Natural Language Processing	DSAL4593	3
Natural Language Processing Lab	DSAL4591	1
Schema-less Databases	DSDB3323	3
Design & Analysis of Algorithms	DSAL3523	3

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

Course Title	Code	Cr. Hrs.
Calculus and Analytical Geometry	DSSS1813	3
Linear Algebra	DSSS2873	3
Probability and Statistics	DSSS2863	3
Basic Electronics	DSSS1823	3

c) Humanities Courses (18 Cr. Hrs.)

English Composition & Comprehension	DSHU1633	3
Pakistan Studies	DSHU1613	3
Islamic Studies	DSHU1623	3
Communication & Presentation Skills	DSHU1663	3
Technical and Business Writing	DSHU2673	3
Professional Practices	DSGE4753	3

d) Supporting Courses (09 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
Supporting I	DSXXxxx3	3
Supporting II	DSXXxxx3	3
Supporting III	DSXXxxx3	3
For support courses choose any 03 from the following list		
Differential Equations	DSSS2833	3
Introduction to Stochastic Processes	DSSS2843	3
Introduction to Machine Learning	DSAL4583	3
Optimization Techniques	DSDS2133	3
Applied Statistics	DSSS2853	3
Tools and Techniques for Data Science	DSDS2143	3

e) Data Science Elective Courses (15 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
DS Elective I	DSXXxxx3	3
DS Elective II	DSXXxxx3	3
DS Elective III	DSXXxxx3	3
DS Elective IV	DSXXxxx3	3
DS Elective V	DSXXxxx3	3

List of Data 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 data science.

Course Title	Code	Cr. Hrs.
Image Processing	DSAL3543	3
Computer Vision	DSAL3553	3
Introduction to Biomedical Image Processing	DSAL3563	3
Deep Learning	DSDS3153	3
Generative Adversarial Networks	DSNS3443	3
Deep Reinforcement Learning	DSDS3173	3
Unsupervised Deep Learning	DSDS3183	3
Deep Recurrent Neural Networks	DSDS3193	3
Exploratory Data Analysis and Visualization	DSDS3163	3
Information Retrieval	DSDB3343	3
Bio Informatics	DSSS3883	3
Semantic Web	DSNS3463	3
Business Analytics	DSSS3893	3
Deep Natural Language Processing	DSAL3573	3
Block Chain	DSNS3473	3
Data Modeling & Forecasting	DSSS4813	3
Distributed Computing	DSNS3483	3
Distributed Databases	DSNS4493	3

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

Course Title	Code	Cr. Hrs.
University Elective I	DSXXxxx3	3
University Elective II	DSXXxxx3	3
University Elective III	DSXXxxx3	3
University Elective IV	DSXXxxx3	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 data science by designing and implementing a design project worth 06 Cr. Hrs. The project shall be completed in two parts as given below:

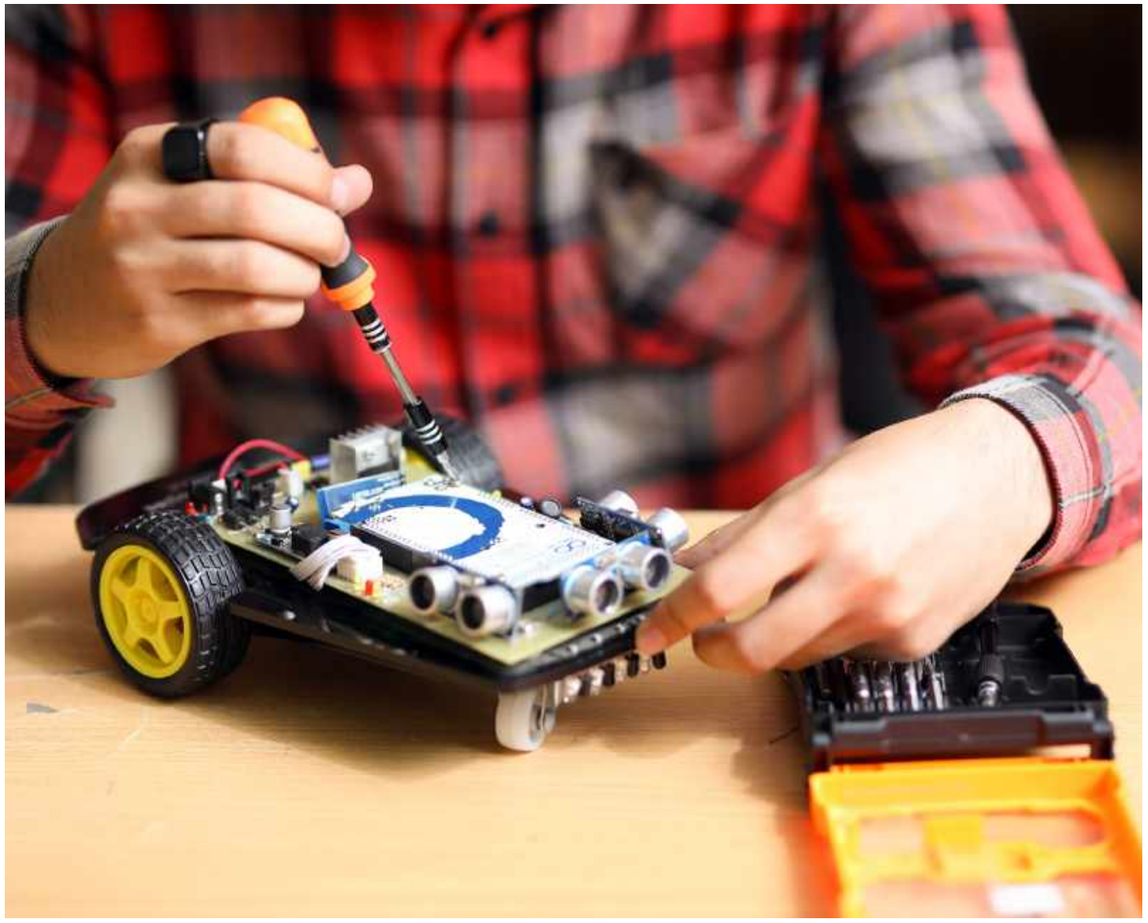
Course Title	Code	Cr. Hrs.
Final Year Project I	DSSD4913	3
Final Year Project II	DSSD4923	3

Community Service (DS4000)

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.

Program Duration

This is a 4-year degree program comprising of 8 semesters with a minimum of 133 Cr. Hrs. There will be a Fall and a Spring semester in each year. The summer semester will be utilized for internship or deficiency courses. The minimum and maximum duration to complete BS Data Science degree is 4 and 7-years, respectively.



Scheme of Studies: BS Data Science Program

Semester-I (16 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
DSCP1013	Introduction to Computing	Core	3
DSCP1011	Introduction to Computing Lab	Core	1
DSHU1643	Logic Thinking (UCP Elective I)	Uni Elective	3
DSHU1633	English Composition & Comprehension	Humanities	3
DSSS1823	Basic Electronics	Math Science	3
DSHU1613	Pakistan Studies	Humanities	3

Semester-II (16 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
DSCP1023	Programming Fundamentals	Core	3
DSCP1021	Programming Fundamentals Lab	Core	1
DSDS1113	Fundamentals of Data Science	Core	3
DSSS1813	Calculus and Analytical Geometry	Math Science	3
DSHU1663	Communication & Presentation Skills	Humanities	3
DSHU1623	Islamic Studies	Humanities	3

Semester-III (17 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
DSCP2033	Object Oriented Programming	Core	3
DSCP2031	Object Oriented Programming Lab	Core	1
DSDS2123	Big Data Programming	Core	3
DSDS2121	Big Data Programming Lab	Core	1
DSXXxxx3	Supporting I	Supporting	3
DSAL2513	Discrete Structures	Core	3
DSXXxxx3	UCP Elective II	Uni Elective	3

Semester-IV (17 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
DSSS2863	Probability and Statistics	Math Science	3
DSCP2043	Data Structures and Algorithms	Core	3
DSCP2041	Data Structures and Algorithms Lab	Core	1
DSDB2313	Introduction to Database Systems	Core	3
DSDB2311	Introduction to Database Systems Lab	Core	1
DSSS2873	Linear Algebra	Math Science	3
DSHU2673	Technical and Business Writing	Humanities	3

Scheme of Studies: BS Data Science Program

Semester-V (16 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
DSDB3323	Schema-less Databases	Core	3
DSNS3413	Operating Systems	Core	3
DSNS3411	Operating Systems Lab	Core	1
DSXXxxx3	Supporting II	Supporting	3
DSXXxxx3	DS Elective I	DS Elective	3
DSAL3533	Design and Analysis of Algorithms	Core	3

Semester-VI (17 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
DSDB3333	Data Mining	Core	3
DSDB3331	Data Mining Lab	Core	1
DSAL3533	Artificial Intelligence	Core	3
DSNS3423	Computer Comm. and Networks	Core	3
DSNS3421	Computer Comm. and Networks Lab	Core	1
DSXXxxx3	DS Elective II	DS Elective	3
DSSD3213	Software Engineering	Core	3

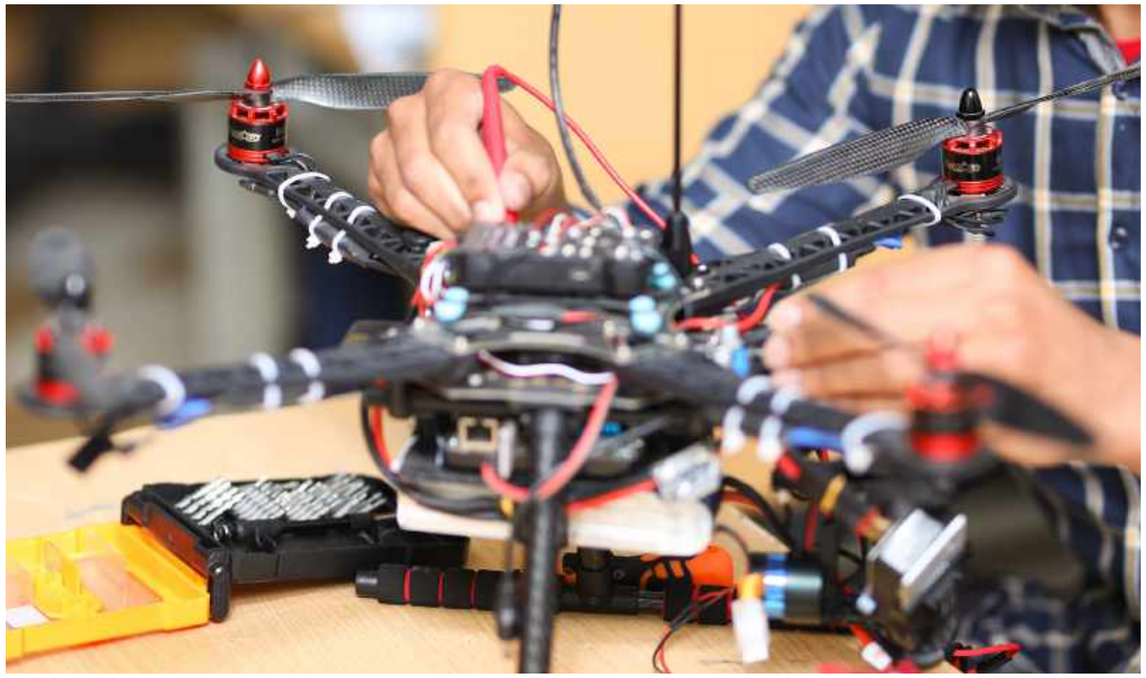
Scheme of Studies: BS Data Science Program

Semester-VII (18 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
DSGE4753	Professional Practices	Humanities	3
DSXXxxx3	Supporting I	Supporting	3
DSXXxxx3	UCP Elective III	Uni Elective	3
DSXXxxx3	DS Elective III	DS Elective	3
DSXXxxx3	DS Elective IV	DS Elective	3
DSSD4913	Final Year Project I	Core	3

Semester-VIII (16 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
DSAL4593	Natural Language Processing	Core	3
DSAL4591	Natural Language Processing Lab	Core	1
DSNS4433	Information Security	Core	3
DSXXxxx3	DS Elective V	DS Elective	3
DSXXxxx3	UCP Elective IV	Uni Elective	3
DSSD4923	Final Year Project II	Core	3



MS COMPUTER SCIENCE

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
(iv) Admission Test/HEC Approved Test

Degree Requirements

A student admitted in this program will have to complete the degree requirements by following any one of the options given below:

(i) 24 Cr. Hrs course work with 6 Cr. Hrs Thesis
(ii) Course work only (10 Courses)

Each candidate for the MS Computer Science degree is required to successfully earn 30 Cr. Hrs. with the CGPA 2.5 on a scale of 4.0 as per the following details:

	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
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
Parallel Computing	CSSC5313	3
Distributed Systems	CSSC5323	3
Theory of Programming Languages	CSSC5343	3
Advanced Database Systems	CSDS5413	3
Data Mining	CSDS5423	3
Data Warehousing	CSDS6443	3
Information Retrieval Techniques	CSDS5443	3
Mobile Communication Systems	CSNS5533	3
Network Security	CSNC5423	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
Fuzzy Automata and Languages	CSSC6353	3
Advanced Compiler Techniques	CSSC6363	3

Course Title	Code	Cr. Hrs.
Advanced Data Mining	CSDS6453	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
Genetic Algorithms	CSAC6663	3
Operations Research-II	CSSC7383	3
Distributed Knowledge Engineering	CSCI7253	3
Advanced Topics in Formal Methods	CSSE5063	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

c) Research Thesis

Research Thesis	CSRW6916	6
Thesis Continuation	CSRW6921	1

Program Duration

This is nominally a 2-year degree program comprising of 4 semesters with a minimum of 30 Cr. Hrs. There will be a Fall and a Spring semester in each year. The summer semester will be utilized for deficiency courses. The maximum duration to complete MS Computer Science degree is 4-years.

MS DATA SCIENCE

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% marksAdmission Test/HEC Approved Test

Degree Requirements

A student admitted in this program will have to complete the degree requirements by following any one of the options given below:

(i) 24 Cr. Hrs. course work with 6 Cr. Hrs. Thesis
(ii) 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 2.5 on the scale of 4.0 as per the following details:

	Area	Cr. Hrs.
a)	Core Courses	12
b)	Specialization	06
c)	Electives	06
d)	Thesis/Additional Courses	06
	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	DSAI6313	3
Natural Language Processing	DSAI6323	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
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

Program Duration

This is a 2-year degree program comprising of 4 semesters with 30 Cr. Hrs. There will be a Fall and a Spring semester in each year. The summer semester will be utilized for deficiency courses. The maximum duration to complete MS Data Science degree is 4-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 can 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; 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.

Admission Requirements

(i) MS degree in relevant discipline
(ii) Minimum CGPA 3.0/4.0 (Semester System) or 60% marks (Annual System)
(iii) Admission Test/GAT Subject/HEC Test
(iv) Interview

Degree Requirements

A PhD candidate shall be awarded 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
(v) Dissertation Foreign Reviews
(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)

DEPARTMENT OF SOFTWARE ENGINEERING

Admission Requirements

(i) At least 50% marks in F.Sc (Pre-Medical/Pre-Engineering/ICS/A-Levels or equivalent qualification with Mathematics certified by IBCC.
(ii) Applicant will clear UCP test or equivalent.

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

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 and Architecture	SESD2223	3
Software Construction and Development	SESD3243	3
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.)

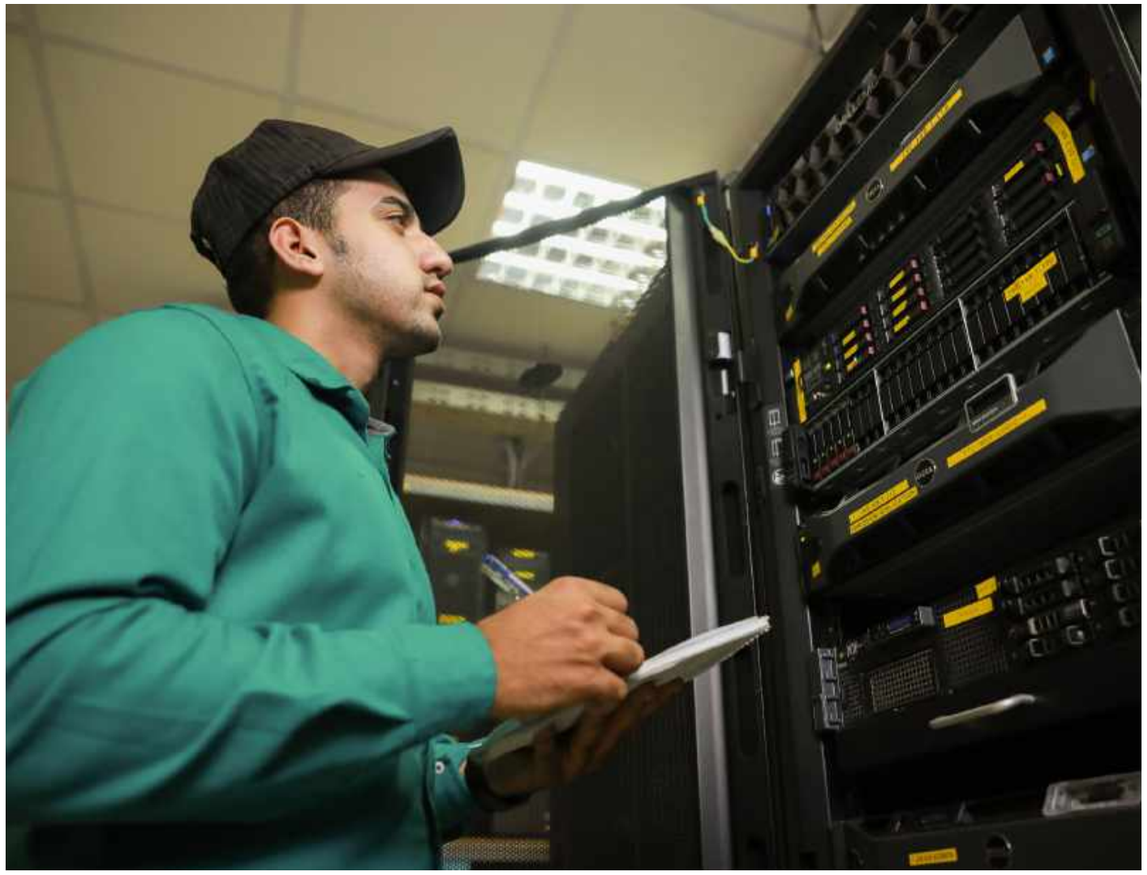
Course Title	Code	Cr. Hrs.
Calculus and Analytical Geometry	SESS1713	3
Basic Electronics	SESS1723	3
Linear Algebra	SESS2743	3
Probability and Statistics	SESS2733	3

c) Humanities Courses (18 Cr. Hrs.)

Course Title	Code	Cr. Hrs.
English Composition & Comprehension	SEHU1833	3
Pakistan Studies	SEHU1813	3
Islamic and Religious Studies	SEHU1823	3
Communication & Presentation Skills	SEHU1863	3
Technical and Business Writing	SEHU2873	3
Professional Practices	SEGE3953	3

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 Software Engineering Elective Courses)

Following list is non-exhaustive:

Course Title	Code	Cr. Hrs.
Object Oriented Software Engineering	SESE4153	3
Web Application Development	SECP4063	3
Software Configuration Management	SESM4333	3
Software Development Risk Analysis	SESM4343	3
Artificial Intelligence	SEAD3433	3
Mobile Application Development	SECP3053	3
Data Science	SEAD3443	3
Multimedia Communication	SENS4543	3
Global Software Development	SEST4623	3
Game Application Development	SEST4633	3
Design Patterns	SEST4653	3
Computer Graphics	SEST3663	3
Software Analysis and Design	SESD4273	3
Semantic Web	SEST4643	3
Cloud Computing	SEST3673	3
Software Testing	SESD3253	3
Software Quality Assurance	SESM3363	3
Machine Learning	SEAD3453	3
Big Data Programming	SECP4073	3

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

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

Community Service (SE4000)

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.

Program Duration

This is a 4-year degree program comprising of 8 semesters with a minimum of 133 Cr. Hrs. There will be a Fall and a Spring semester in each year. The summer semester will be utilized for internship or deficiency courses. The minimum and maximum duration to complete BS Software Engineering degree is 4 and 7-years, respectively.

Scheme of Studies: BS Software Engineering Program

Semester-I (16 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
SECP1013	Introduction to Computing	Core	3
SECP1011	Introduction to Computing Lab	Core	1
SEHU1833	English Composition & Comprehension	Humanities	3
SESS1713	Calculus and Analytical Geometry	Math Science	3
SESS1723	Basic Electronics	Math Science	3
SEHU1813	Pakistan Studies	Humanities	3

Semester-II (16 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
SECP1023	Programming Fundamentals	Core	3
SECP1021	Programming Fundamentals Lab	Core	1
SEHU1863	Communication & Presentation Skills	Humanities	3
SEAD1413	Discrete Structures	Core	3
SESE1113	Software Engineering	Core	3
SEHU1823	Islamic and Religious Studies	Humanities	3

Semester-III (16 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
SECP2033	Object Oriented Programming	Core	3
SECP2031	Object Oriented Programming Lab	Core	1
SESD2213	Software Requirements Engineering	Core	3
SESE2123	Human Computer Interaction	Core	3
SESS2743	Linear Algebra	Math Science	3
SEZZzzz3	UCP Elective I	Uni Elective	3

Semester-IV (16 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
SECP2043	Data Structures and Algorithms	Core	3
SECP2041	Data Structures and Algorithms Lab	Core	1
SESD2223	Software Design and Architecture	Core	3
SESS2733	Probability and Statistics Math Science	3	
SEZZzzz3	Supporting I	Supporting	3
SEHU2873	Technical and Business Writing	Humanities	3

Scheme of Studies: BS Software Engineering Program

Semester-V (17 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
SENS3513	Operating Systems	Core	3
SENS3511	Operating Systems Lab	Core	1
SEAD3423	Introduction to Database Systems	Core	3
SEAD3421	Introduction to Database Systems Lab	Core	1
SESD3233	Web Engineering	Core	3
SEZZzzz3	UCP Elective II	Uni Elective	3
SEZZzzz3	Supporting II	Supporting	3

Semester-VI (19 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
SESM3313	Software Quality Engineering	Core	3
SENS3523	Computer Comm. and Networks	Core	3
SENS3521	Computer Comm. and Networks Lab	Core	1
SEGE3953	Professional Practices	Humanities	3
SESD3243	Software Construction and Development	Core	3
SEZZzzz3	SE Elective I	SE Elective	3
SEZZzzz3	Supporting III	Supporting	3

Semester-VII (18 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
SENS4533	Information Security	Core	3
SESM4323	Software Project Management	Core	3
SESE4143	Software Re-engineering	Core	3
SEZZzzz3	SE Elective II	SE Elective	3
SEZZzzz3	SE Elective III	SE Elective	3
SESD4913	Final Year Project I	Core	3

Semester-VIII (15 Cr. Hrs.)

Course Code	Course Title	Category	Cr. Hrs.
SEZZzzz3	SE Elective IV	SE Elective	3
SEZZzzz3	SE Elective V	SE Elective	3
SEZZzzz3	UCP Elective III	Uni Elective	3
SEZZzzz3	UCP Elective IV	Uni Elective	3
SESD4923	Final Year Project II	Core	3