

**Amendments approved in 9<sup>th</sup> board of study held on 30-08-2021 at 11:00 a.m. have been incorporated in this document**

## **AGENDA**

**FOR**

### **8<sup>th</sup> MEETING OF THE BOARD OF STUDIES**

**DEPARTMENT OF COMPUTER SCIENCE & INFORMATION  
TECHNOLOGY (CS & IT),**

**MIRPUR UNIVERSITY OF SCIENCE AND TECHNOLOGY (MUST),  
MIRPUR AZAD KASHMIR**

**The 8<sup>th</sup> Meeting of the Board of Studies in the Department of Computer Science & Information Technology will be held on 02-09-2020 at 11:00 a.m. with the following items and subjects.**

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**CURRICULUM FOR DOCTOR OF PHILOSOPHY IN  
COMPUTER SCIENCE (Ph.D. (CS)),  
Department of Computer Science & Information  
Technology (CS&IT),  
Mirpur University of Science & Technology (MUST),  
Mirpur-10250 (AJ&K)**

**Item No. 1**

**Approval of Scheme of Studies for 3-years PhD (CS)  
Program**

## 1. Introduction

Department of Computer Science and Information Technology is offering the Ph.D. degree program in Computer Science. The main objective of this program is to provide a route to professional doctorate and to prepare scientific/educational manpower with a depth of knowledge and research competence of international level to fill positions in Research Organizations, Industry, Management, Universities, Health Care and Educational Institutions. Our main aim is to improve the qualifications, skills and expertise of teachers and researchers in order to provide highly competent professionals to various public and private universities and colleges in the globe.

### 1.1 General Breakup

Content		Description	Remarks
1.1	Awarding Institute/Body	Mirpur University of Science and Technology (MUST)	
1.2	Teaching Institute	Department of Computer Science & Information Technology, MUST, Mirpur, AK	
1.3	Final Award	Doctor of Philosophy	
1.4	Program Title	Ph.D in Computer Sciences	
1.5	Starting Time for Program	Spring/Fall Semester of Every Academic Year	
1.6	Duration of the Program	3 to 8 years (6-16 Semesters)	
1.7	Entrance Requirement	As per HEC Policy	
1.8	Merit Formula	As per HEC Policy	
1.9	Total Credit Hours	Course Work: 18 Credit Hrs	
		Thesis (CS-8000): 50 Credit Hrs	
		Seminar I & II (CS-7998, 7999): 1 Credit Hrs each	
		Comprehensive Examination (Written and Oral): P/F	

## 1.2 Program Educational Objectives

Our scholar will be equipped not only with advanced computer science tools but will also acquire research skills needed to apply computer science knowledge towards real-life problems in different filed of engineering, sciences, economics, business, healthcare, etc. Moreover, our graduates will be able to:

- Collaborate with engineers and scientists from industry and academia in their research/projects to promote the industry-academia linkages;
- Promote the culture the interdisciplinary novel research and produce fundamental & applied quality research in Pakistan.
- Contribute through active research in emerging areas of science, engineering and technology for instance artificial intelligence, data science, network security, distributed computing, semantic web, autonomous computing etc.

## 1.3 Program Learning Outcomes (PLOs)

- The scholar will be able to exhibit specialized knowledge and ability to use appropriate research methodology in the relevant field of study
- The scholar will be able to conduct systematic and focused research
- The scholar will be able to publish research papers in journals and conferences of international repute
- The scholar will be able to conduct and supervise independent research and can produce knowledge

## 1.4 Program Structure, Credit and Award Requirements

The following is program structure and related credit hours:

Category or Area	No. of Courses	Credit Hours
Courses	06	18
Reading Seminars	02	02
Research/Thesis	01	50
<b>Total Credit Hours</b>		<b>70</b>

## 1.5 Ph.D. (CS) Semester wise breakdown

Courses will be offered subject to the suitability and availability of the faculty.

### 1.5.1 Semester -I

One compulsory course CS-8001 (Advanced Topics in Research Methodology) and two elective courses from the specialized area will be offered in the first semester.

### 1.5.2 Semester-II

Three elective courses from the specialized area will be offered in the second semester.

### 1.5.3 Semester-III

After completing the course work with a minimum CGPA of 3.0/4.0 each, the scholar will clear the Comprehensive Examination (Written and Oral) by the end of the 3rd semester, or by the end of the 4<sup>th</sup> semester (if it is not cleared in 3<sup>rd</sup> semester). **This exam must be passed within two years of admission, failing which the admission shall be cancelled.**

### 1.5.6 Semester-IV to VI

The scholar will submit synopsis in the 2<sup>th</sup>/3<sup>th</sup> semester to the relevant body and after approval of the synopsis, research work will start formally. The acceptance of synopsis through departmental committee and endorsed by AS&RB in 2<sup>nd</sup> year. The two Seminars will be evaluated after the submission of synopsis and before the public defence of the thesis. After completing the research work and the degree award requirements, the process for the public defence will be started. The scholar who can't finish their thesis by the end of the 6<sup>th</sup> semester will seek approval from the relevant authority (AS&RB) for an extension to complete his/her degree.

Ph.D. (Computer Science) Semester Plan			
Sr.No	Code	Course Title	CrHrs
<b>Year 1 Semester I</b>			
1	CS-8001	Advanced Research Methodology	3
2	CS-80xx	Elective-I	3
3	CS-80xx	Elective-II	3
		<b>Total</b>	<b>9</b>
<b>Year 1 Semester II</b>			
4	CS-800x	Elective-III	3
5	CS-80xx	Elective-IV	3
6	CS-80xx	Elective-V	3
		<b>Total</b>	<b>9</b>
<b>Year 2 Semester III &amp; IV</b>			

7		Comprehensive Examination (Max. two Attempts)	P/F
8	CS-8000	Synopsis/Research Proposal (Max. Two Attempts)	A/D
9	CS-7998	Reading Seminar 1	1
		<b>Total</b>	<b>1</b>
<b>Year 3 Semester V, VI</b>			
10	CS-7999	Reading Seminar 2	1
11	CS-8000	Research/Thesis	50
		<b>Total</b>	<b>51</b>

## 1.6 List of Courses for Ph.D. Program

### Elective Courses\* (18 credit hrs)

A scholar will have to complete 18 credit hours of his/her course work from these courses on the recommendation of his/her supervisor. The following list is not exhaustive. The supervisor may include courses relevant to the research field of the scholar(s).

<b>Courses</b>		
<b>Code</b>	<b>Course Title</b>	<b>Cr. Hrs</b>
CS-8001	Advanced Research Methodology	3
CS-8002	Advanced Computer Architecture	3
CS-8003	Advanced Algorithm Analysis	3
CS-8004	Advanced Theory of Advanced Computing Models	3
CS-8005	Advanced Operating Systems	3
CS-8006	Advanced Mathematics for Computing	3
CS-8007	Advanced Software Engineering Technology	3
CS-8008	Advanced Computer and Communication Networking	3
CS-8009	Advanced Network Programming	3
CS-8010	Advanced Computer Networks	3
CS-8011	Advanced Cryptography and Security Mechanisms	3
CS-8012	Advanced Wireless Networks	3
CS-8013	Advanced Network Security	3
CS-8014	Advanced Network Performance Evaluation	3
CS-8015	Advanced Wireless and Mobile Computing Networks	3
CS-8016	Advanced Autonomous Computing	3
CS-8017	Advanced Design of Intelligent Systems	3
CS-8018	Advanced Decision Support Systems	3
CS-8019	Advanced Machine Learning	3
CS-8020	Advanced Neural Networks	3



CS-8021	Advanced Natural Language Processing	3
CS-8022	Advances in Agents	3
CS-8023	Advances in Robotics	3
CS-8024	Advances in Pattern Recognition	3
CS-8025	Advanced Computational Intelligence	3
CS-8026	Advanced Software Engineering	3
CS-8027	Advanced Software Project Management	3
CS-8028	Advanced Object-Oriented Software Engineering	3
CS-8029	Advanced Software Quality Assurance and Testing	3
CS-8030	Advanced Software Requirements Engineering	3
CS-8031	Advanced Software Architectures	3
CS-8032	Advances in Software Patterns	3
CS-8033	Advanced Digital Image Processing	3
CS-8034	Advanced Digital Signal Processing	3
CS-8035	Advanced Computer Vision	3
CS-8036	Advanced Digital Watermarking and Steganography	3
CS-8037	Advanced Multi-view Geometry	3
CS-8038	Advanced 3D Computer Vision	3
CS-8039	Advanced Multispectral Image Processing	3
CS-8040	Advanced Design for Usability	3
CS-8041	Advanced Modelling of Web Information Systems	3
CS-8042	Advanced Data Warehousing	3
CS-8043	Advanced Peer-To-Peer Systems	3
CS-8044	Advanced Social Network Analysis	3
CS-8045	Advanced Multimedia Retrieval Techniques	3
CS-8046	Advanced Metadata for Information Resources	3
CS-8047	Advanced Multimedia Communications	3
CS-8048	Advanced Human Information Interaction	3
CS-8049	Advanced Software Evolution and Reengineering	3
CS-8050	Advanced Program Comprehension and Reverse Engineering	3
CS-8051	Advanced Mining Massive Datasets	3
CS-8052	Advanced Social Media Content Analysis	3
CS-8053	Advanced Software Repositories Mining	3
CS-8054	Advanced Metadata Model Management	3

CS-8055	Advanced Cloud Computing	3
CS-8056	Advanced Digital Forensics	3
CS-8057	Advances in Big Data and Hadoop Essentials	3
CS-8058	Advanced Artificial Neural Networks	3
CS-8059	Advance Modelling and Simulations	3
CS-8060	Advances in Distributed Databases	3
CS-8061	Advances in Distributed Data Processing	3
CS-8062	Advanced Learning from Data	3

\*Apart from this list, a student may also register in a course with MSCS class with the consent of his/her supervisor provided the student did not take this course already while doing MSCS.

## **1.7 Approval of External/Local Examiners for PhD (CS) Thesis Evaluation**

### **1.7.1 External Examiners for Ph.D. Thesis Evaluation**

Tentative list of external examiners as per the availability.

1. Wha Sook Jeon  
Professor  
Mobile Computing and Communications Lab  
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Department of Computer Science and Engineering  
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Computer Architecture and Embedded Systems Lab  
Department of Computer Science and Engineering  
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4. Jin-Soo Kim  
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6. Xin-She Yang  
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8. Professor Alessandro Abate,  
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11. Alex Aiken  
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12. Margaret-Anne Storey  
Professor  
Co-Director, Matrix Institute for Applied Data  
Computer Human Interaction and Software Engineering Lab (CHISEL)  
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13. Moses Charikar  
Stanford University, USA  
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14. Anya Helene Bagge  
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15. Michael Albert  
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17. Anthony Robins  
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## **1.7.2 Local Examiners for Ph.D. Thesis Evaluation**

1. Dr. Umar Shahbaz khan  
Associate Professor,  
Department of Mechatronics Engineering  
CE & ME

National University of Sciences and Technology (NUST)  
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2. Dr. Muhammad Haroon Yousaf  
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3. Dr. Zohaib Iqbal,  
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4. Prof. Dr. Muaz A. Niazi  
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5. Dr. Anayat ullah Baloch  
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6. Dr. Tayab Din Memon  
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7. Dr. Mehrosh Khalid  
Ph.D. Computer Science  
Areas of interest are: Machine Learning, Data Mining, Artificial Intelligence,  
Programming, Computational Biology  
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11. Dr. Ayyaz Hussain  
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12. Dr. Salabat Khan  
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13. Dr. Muhammad Nazir  
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14. Dr Muhammad Maaz Rehan  
Designation: Assistant Professor  
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15. Dr Muhammad Azeem Abbas  
Designation: Assistant Professor  
Department: University Institute of Information Technology  
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16. **Dr Kashif Sattar**

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Area of Interests: Sensor Networks, Network Security

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17. **Dr. Javed Iqbal** (HEC Approved Supervisor)

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18. **Dr. Muhammad Shiraz**

Assistant Professor,

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**Item No. 2**

**Approval/ Adaptation of Scheme of Studies for 2-years MS  
(CS) Program as per HEC revised curriculum of 2016-17**

## **2. Curriculum for MS (Computer Science)**

### **2.1 Program Objectives**

The MS (Computer Science) comprises of both course work as well as research component. There are 'four cores' aimed at the strengthening the understanding and competence of students in computer science fundamentals. The university expect its MS graduates to pursue career either as computer science faculty or software development managers.

### **2.2 Learning Objectives**

- Students will be able to possess advanced knowledge of Computer science field
- Students will be able to think creatively and critically; to solve-trivial problems
- Students will be able to use computing knowledge to develop efficient solutions for real life problems
- Students will be able to design solutions and can conduct research related activities.

### **2.3 Eligibility**

Degree in relevant subject, earned from a recognized university after 16 years of education with at least 60% marks or CGPA of at least 2.0 (on a scale of 4.0).

The following core courses are recommended to be completed before entering the MS (CS) program.

1. Analysis of Algorithms
2. Assembly Lang. / Computer Architecture
3. Computer Networks
4. Computer Programming
5. Data Structures
6. Database Systems
7. Operating Systems
8. Software Engineering
9. Theory of Automata

A student selected for admission having deficiency in the above stated courses may be required to study a maximum of FOUR courses, which must be passed in the first two semesters. Deficiency courses shall be determined by the Graduate Studies Committee, before admitting the student.

A student cannot register in MS courses, unless all specified deficiency courses have been passed.

- BS (CS/IT/SE) 4-years

OR

M.Sc. (Computer Science) or MCS / MIT 2-years

- At least 2<sup>nd</sup> Division or CGPA 2.0/4.0 required.
- No 3<sup>rd</sup> Division in academic record.

University Test OR GAT General conducted by NTS with minimum 50% cumulative score, as per decision of the University.

## 2.4 MS (CS) Programme Structure

The syllabi and courses of reading for MS computer science (CS) Semester-I and Semester-II of session (2010-21) and onward are hereby notified. A total of 31 credit hours of work is required for MS (CS).

Duration	4-8 Semesters (for full time students)
Courses	24 Credit Hrs
Research Methodology	01 Credit Hrs
Thesis	06 Credit Hrs
Total	31 Credit Hrs

## 2.5 Category wise Credit Hours Distribution

Category or Area	Credit Hours
Core	12
Elective	12
Mandatory	01
Thesis	06
<b>Total Credit Hours</b>	<b>31</b>

## 2.6 Examination

The examination rules will be adopted according to the University Semester System and thesis regulations will be adopted according to MUST graduate's thesis regulations. Thesis topic will be chosen with the consent of supervisor(s).

## 2.7 Tentative Study Plan of MS (Computer Science)

### Semester – I

CS 5xx Core Course – I	3
CS 5xx Core Course – II	3
CS 5xx Core Course – III	3
CS 5xx Elective – III	3
Total	12

### Semester – II

CS 5xx Core Course – IV	3
CS 5xx Elective – I	3
CS 5xx Elective – II	3
SS 3xx Research Methodology	1
CS 5xx Elective-IV	3
Total	13

### Semester – III

CS 5xx MS Thesis- 1	6
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### Semester – IV

CS 5xx MS Thesis-II	6
Total	31

## 2.8 Scheme of Studies for MS Computer Science

Courses will be offered subject to the suitability and availability of the faculty. However, the students will have to defend their thesis proposal / synopsis at the end of their third semester, as a full-time student.

Code	Course Title	Cr. Hrs
<b>Core Courses</b>		
CS-5101	Advanced Analysis of Algorithms	3
CS-5102	Advanced Theory of Automata	3
CS-5105	Advanced Operating System	3
Cs-5107	Theory of programming Languages	3
<b>Mandatory Courses</b>		
CS-5103	Research Methodology	1

<b>Elective Courses</b>		
<b>Computer Networks and Security</b>		
CS-5104	Advanced Network Programming	3
CS-5105	Advanced Computer Networks	3
CS-5106	Introduction to Cryptography and Security Mechanisms	3
CS-5107	Advanced Wireless Networks	3
CS-5201	Advanced Network Security	3
CS-5202	Network Performance Evaluation	3
CS-5203	Advanced Wireless and Mobile Computing Networks	3
CS-5204	Autonomous Computing	3
<b>Artificial Intelligence</b>		
CS-5108	Design of Intelligent Systems	3
CS-5109	Decision Support Systems	3
CS-5205	Machine Learning	3
CS-5206	Advanced Neural Networks	3
CS-5207	Natural Language Processing	3
CS-5208	Agents	3
CS-5209	Robotics	3
CS-5210	Pattern Recognition	3
CS-5211	Computational Intelligence	3
<b>Software Engineering</b>		
CS-5110	Advanced Software Engineering	3
CS-5111	Advanced Software Project Management	3
CS-5212	Object-Oriented Software Engineering	3
CS-5213	Software Quality Assurance and Testing	3
CS-5214	Software Requirements Engineering	3
CS-5215	Software Architectures	3
CS-5216	Software Patterns	3
<b>Digital Signal and Image Processing / Computer Vision</b>		
CS-5112	Advanced Digital Image Processing	3
CS-5113	Advanced Digital Signal Processing	3
CS-5114	Computer Vision	3
CS-5217	Digital Watermarking and Steganography	3
CS-5218	Multi-view Geometry	3
CS-5219	3D Computer Vision	3
CS-5220	Multispectral Image Processing	3
<b>Other Elective Courses</b>		
CS-5115	Advanced Computer Architecture	3
CS-5116	Advanced Operating System	3
<b>CS-5117</b>	<b>Knowledge Engineering and Semantic Web</b>	<b>3</b>
<b>Thesis</b>		
CS-6101	MS Thesis	6

\*Apart from this list, a student may also register in a course with Ph.D class with the consent of his/her supervisor.

## **Item No. 3**

**Approval /Adaptation of 2016-17 curriculum of HEC  
for BS (CS), BS (IT)  
&  
Curriculum of BS (Artificial Intelligence) and BS  
(Cyber Security) Programs, March 2020**

### **3. Curriculum for BS (Computer Science) and BS (Information Technology)**

#### **3.1 BS Computer Science**

Computer science is the study of the theory, experimentation, and engineering that form the basis for the design and use of computers. It is the scientific and practical approach to computation and its applications and the systematic study of the feasibility, structure, expression, and mechanization of the methodical procedures (or algorithms) that underlie the acquisition, representation, processing, storage, communication of, and access to information [ref WordNet Princeton definition].

Computer Science is the application of a systematic, disciplined and quantifiable approach to the design, development, operation, and maintenance of software systems. It is in fact the practice of designing and implementing large, reliable, efficient and economical software by applying the principles and practices of engineering. The program aims to train students in all aspects of software life cycle from specification through analysis and design to testing, maintenance and evaluation of software product.

#### **Coverage of ACM Knowledge Areas**

Computer Science curriculum is designed keeping in view following identified knowledge areas of ACM [ref # ACM 2013 curriculum report]. It has been tried to reasonably cover all knowledge areas without compromising the flexibility needed for a national model curriculum.

- AL - Algorithms and Complexity
- AR - Architecture and Organization
- CN - Computational Science
- DS - Discrete Structures
- GV - Graphics and Visual Computing
- HCI - Human-Computer Interaction
- IAS - Information Assurance and Security
- IM - Information Management
- IS - Intelligent Systems
- NC - Networking and Communications
- OS - Operating Systems
- PBD - Platform-based Development
- PD - Parallel and Distributed Computing
- PL - Programming Languages
- SDF - Software Development Fundamentals



- SE - Software Engineering
- SF - Systems Fundamentals
- SP - Social Issues and Professional Issues

### 3.2 Proposed Curriculum for BS (Computer Science)

Areas covered in BS Program

<b>Course Group</b>	<b>Credit hours</b>	<b>% age</b>
General Education	19	15%
University Electives	12	9%
Mathematics & Science Foundation	12	9%
Computing – Core	39	30%
<b>Common courses</b>	<b>82</b>	<b>63%</b>
<b>Domain CS</b>		
Domain CS Core	24	18%
Domain CS Electives	15	12%
Domain CS Supporting	9	7%
<b>Domain courses</b>	<b>48</b>	<b>37%</b>
<b>TOTAL</b>	<b>130</b>	<b>100%</b>

#### Courses common for all computing BS programs – 82 Credits

<b>Computing Core Courses Course Title</b>	<b>Credit hours</b>
Programming Fundamentals	3-1
Object Oriented Programming	3-1
Data Structures & Algorithms	3-1
Discrete Structures	3-0
Operating Systems	3-1
Database Systems	3-1
Software Engineering	3-0
Computer Networks	3-1
Information Security	3-0
Final Year Project	0-6
<b>Total</b>	<b>39 (27-12)</b>
<b>General Education Courses</b>	
<b>Course Title</b>	<b>Credit hours</b>
English Composition & Comprehension	3
Technical & Business Writing	3

Communication & Presentation Skills	3
Professional Practices	3
Intro to Info. & Comm. Technologies	2-1
Pakistan Studies	2
Islamic Studies/ Ethics	2
<b>Total</b>	<b>18-1</b>

#### **University Elective Courses**

<b>Course Title</b>	<b>Credit hours</b>
Foreign Language	2-0
Social Service	1-0
Management Related	3-0
Social Science Related	3-0
Economy Related	3-0
<b>Total</b>	<b>12-0</b>

#### **Mathematics and Science Foundation Courses**

<b>Course Title</b>	<b>Credit hours</b>
Calculus & Analytical Geometry	3-0
Probability & Statistics	3-0
Linear Algebra	3-0
Applied Physics	3-0
<b>Total</b>	<b>12-0</b>

#### **Domain Courses for BS (Computer Science)**

##### **Computer Science CORE (Compulsory) courses**

<b>Course Title</b>	<b>Credit hours</b>
Compiler Construction	3-0
Comp. Organization & Assembly Language	3-1
Digital Logic Design	3-1
Design & Analysis of Algorithms	3-0
Parallel & Distributed Computing	3-0
Artificial Intelligence	3-1
Theory of Automata	3-0
<b>Total</b>	<b>24 (21-3)</b>

##### **Computer Science SUPPORTING courses (ANY 3 from following list)**

Coverage of relevant pre-requisite must be ensured while offering any of the following courses from this category

<b>Course Title</b>	<b>Credit hours</b>
Differential Equations	3-0
Multi-variate Calculus	3-0
Graph Theory	3-0
Theory of Programming Languages	3-0
Numerical Computing	3-0
<b>Total (Any three of the above)</b>	<b>9-0</b>

#### **Computer Science ELECTIVE courses**

<b>Course Title</b>	<b>Credit hours</b>
CS Elective – 1	3
CS Elective – 2	3
CS Elective – 3	3
CS Elective – 4	3
CS Elective – 5	3
<b>Total</b>	<b>15</b>

### **3.3 Proposed Study Plan for BS (Computer Science)**

**4-Years Program (8 Regular Semesters of 18 weeks each)**

#### **Semester-1**

<b>Code</b>	<b>Pre-Req</b>	<b>Title</b>	<b>Lec. Hrs</b>	<b>Lab. Hrs</b>	<b>Credit Hours</b>
BCS-1101	-	Introduction to ICT	2	1	3
BCS-1102	-	Programming Fundamentals	3	1	4
MAT-1115	-	Calculus and Analytical Geometry	3	0	3
PHY-1118	-	Applied Physics	3	0	3
ENG-1107	-	English Composition & Comprehension	3	0	3
		<b>Total:</b>	<b>15</b>	<b>1</b>	<b>16</b>

### Semester-2

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-1201	BCS-1102	Object Oriented Programming	3	1	4
BCS-1202	PHY-1118	Digital Logic Design	3	1	4
ENG-1207	ENG-1107	Communication Skills	3	0	3
STA-1220		Statistics and Probability	3	0	3
PSY-1219		Psychology	3	0	3
		<b>Total:</b>	<b>15</b>	<b>2</b>	<b>17</b>

### Semester-3

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-2301	BCS-1201	Data Structure and Algorithms	3	1	4
BCS-2302		Computer Architecture and Organization	3	1	4
BCS-2303		Discrete Structures	3	0	3
BCS-2304		Information Security	3	0	3
MAT-2315		Differential Equations	3	0	3
		<b>Total:</b>	<b>15</b>	<b>2</b>	<b>17</b>

### Semester-4

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-2401	BCS-2301	Design and Analysis of Algorithms	3	0	3
BCS-2402		Theory of Automata	3	0	3
BCS-2403	BCS-2301	Database Systems	3	1	4
MSG-2404		Micro Processor and Assembly Language	2	1	3
ARA-2401		Arabic	3	0	3
		<b>Total:</b>	<b>14</b>	<b>2</b>	<b>16</b>

### Semester-5

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-3501	BCS-2402	Compiler Construction	3	0	3
BCS-3502		Numerical Computing	3	0	3
BCS-3503	BCS-2301	Operating Systems	3	1	4
BCS-3504		Software Engineering	3	0	3
MAT-3515		Multivariate Calculus	3	0	3
		<b>Total:</b>	<b>15</b>	<b>1</b>	<b>16</b>

**Semester-6**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-3601	BCS-2303	Artificial Intelligence	3	1	4
BCS-3602		Computer Networks	3	1	4
BCS-3603		Human Computer Interaction	3	0	3
BCS-3604		Data Mining	3	0	3
ENG-3607		Technical and Business Writing	3	0	3
		<b>Total:</b>	<b>15</b>	<b>2</b>	<b>17</b>

**Semester 7**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-4701		Fuzzy Logic	3	0	3
BCS-4702		Digital Image Processing	3	0	3
BCS-4703		Final Year Project	0	3	3
ISL-4712		Islamic Studies	2	0	2
BCS-4705	BCS-3503	Parallel & Distributed computing	3	0	3
PS-4717		Pakistan Studies	2	0	2
		<b>Total:</b>	<b>14</b>	<b>3</b>	<b>16</b>

**Semester-8**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-4801		Software Project Management	3	0	3
MGS-4802		Financial Accounting	3	0	3
BCS-4803		Final Year Project	0	3	3
HUM-4804		Professional Practices	3	0	3
HRM-4809		Human Resource Management	3	0	3
		<b>Total:</b>	<b>11</b>	<b>3</b>	<b>15</b>

### 3.4 Proposed Curriculum for BS (Information Technology)

#### Programme's Aims and Objectives

The aim of the BS (IT) program is to produce entrepreneurs of great character, competence, vision and drive equip with up-to-date knowledge, marketable skills, valuable competencies, unique expertise, globally compatible dispositions and culturally and professionally acceptable values to take on appropriate professional roles in information technology domain or proceed to further or higher education or training. One of the key objectives of the program is to equip students with skills and knowledge that enable them to take on appropriate professional positions in IT and grow into leading roles.

#### Category wise Credit Hours Distribution

Course Group	Credit hours	% age
General Education	19	15%
University Electives	12	9%
Mathematics & Science Foundation	12	9%
Computing – Core	39	30%
<b>Common courses</b>	<b>82</b>	<b>63%</b>
<b>Domain IT</b>		
Domain IT Core	24	18%
Domain IT Electives	15	12%
Domain IT Supporting	9	7%
<b>Domain courses</b>	<b>48</b>	<b>37%</b>
<b>TOTAL</b>	<b>130</b>	<b>100%</b>

### 3.5 Proposed Study Plan for BS (Information Technology)

#### 4-Year Program (8 Regular Semesters of 18 weeks each)

#### Semester-1

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-1101	-	Introduction to ICT	2	1	3
BCS-1102	-	Programming Fundamentals	3	1	4
MAT-1115	-	Calculus and Analytical Geometry	3	0	3
PHY-1118	-	Applied Physics	3	0	3
ENG-1107	-	English Composition & Comprehension	3	0	3
		Total:	15	1	16

**Semester -2**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-1201	BCS-1102	Object Oriented Programming	3	1	4
ENG-1207	ENG-1107	Communication and Presentation Skills	3	0	3
BIT-1203		Enterprise Systems	3	0	3
STA-1220		Statistics and Probability	3	0	3
HRM-1209		Human Resource Management	3	0	3
PSY-1219		Psychology	3	0	3
		<b>Total:</b>	<b>18</b>	<b>1</b>	<b>19</b>

**Semester-3**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-2301	BCS-1201	Data Structure and Algorithms	3	1	4
BIT-2302		Modeling and Simulation	3		3
BCS-2303		Discrete Structures	3	0	3
PS-2317		Pakistan Studies	2	0	2
MAT-2305		Linear Algebra	3	0	3
		<b>Total:</b>	<b>15</b>	<b>1</b>	<b>15</b>

**Semester-4**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-2401	BCS-2301	Operating System	3	1	4
BCS-2402		Information Security	3	0	3
BCS-2403		Computer Networks	3	1	4
BIT-2404		IT Project Management	3	0	3
ARA-2401		Arabic	3	0	3
		<b>Total:</b>	<b>15</b>	<b>2</b>	<b>17</b>

**Semester-5**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-3501	BCS-2301	Database Systems	3	1	4
BCS-3502		Software Engineering	3	0	3
BIT-3503		Formal Methods	3	0	3
BIT-3504	BCS-2403	System and Network Administration	3	1	4
IR-3510		International Relations	3	0	3
		<b>Total:</b>	<b>15</b>	<b>2</b>	<b>17</b>

**Semester-6**

<b>Code</b>	<b>Pre-Req</b>	<b>Title</b>	<b>Lec. Hrs</b>	<b>Lab. Hrs</b>	<b>Credit Hours</b>
BIT-3601		Web Technologies	3	0	3
BIT-3602		<b>Semantic Web</b>	<b>3</b>	<b>0</b>	<b>3</b>
BIT-3603		Human Computer Interaction	3	0	3
BIT-3604		IT Infrastructure	3	0	3
ENG-3607		Technical and Business Writing	3	0	3
		<b>Total:</b>	<b>15</b>	<b>0</b>	<b>15</b>

**Semester 7**

<b>Code</b>	<b>Pre-Req</b>	<b>Title</b>	<b>Lec. Hrs</b>	<b>Lab. Hrs</b>	<b>Credit Hours</b>
BIT-4701		Virtual System and Services	3	1	4
BIT-4702		Final Year Project	0	3	3
BIT-4703		Digital Image Processing	3	0	3
BIT-4704		Artificial Intelligence	3	0	3
HUM-4705		Professional Practices	3	0	3
		<b>Total:</b>	<b>11</b>	<b>3</b>	<b>16</b>

**Semester-8**

<b>Code</b>	<b>Pre-Req</b>	<b>Title</b>	<b>Lec. Hrs</b>	<b>Lab. Hrs</b>	<b>Credit Hours</b>
BIT-4801		Final Year Project	0	3	3
BIT-4802		Cyber Security	3	0	3
BIT-4803		IT Project Management	3	0	3
BIT-4804		Database administration and Management	3	1	4
ISL-4812		Islamic Studies	2	0	2
		<b>Total:</b>	<b>11</b>	<b>4</b>	<b>15</b>



### 3.6 BS Artificial Intelligence

The BS (AI) program gives the students an in-depth knowledge they need to transform large and complex scenarios into actionable decisions. The program and its curriculum focus on how complex inputs — such as knowledge, vision, language and huge databases — can be used to make decisions to enhance human capabilities. The curriculum of the BS (AI) program includes coursework in computing, mathematics, automated reasoning, statistics, computational modeling, introduction to classical artificial intelligence languages and case studies, knowledge representation and reasoning, artificial neural networks, machine learning, natural language processing, vision and symbolic computation. The program also encourages students to take courses in ethics and social responsibility, with the opportunity to participate in long term projects in which artificial intelligence can be applied to solve problems that can change the world for the better — in areas like agriculture, defense, healthcare, governance, transportation, e-commerce, finance and education.

### 3.7 Proposed Curriculum for BS (AI)

Following are the proposed areas which are required to be covered to complete the degree. Covered areas consist of core courses (compulsory), foundation courses, general courses and electives.

#### Areas Covered in BS(AI)

<b>Course Group</b>	<b>Credit hours</b>	<b>Min No of Courses</b>
General Education	19	7
University Electives	12	4
Mathematics & Science	12	4
Foundation		
Computing – Core	39	11
Domain CS Core	18	5
AI Core (Domain Core)	18	6
AI Electives (Domain Electives)	12	4
<b>TOTAL</b>	<b>130</b>	<b>41</b>

### 3.8 Proposed Study Plan for BS (Artificial Intelligence)

4-Year Program (8 Regular Semesters of 18 weeks each)

#### Semester-1

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-1101	-	Introduction to ICT	2	1	3
BCS-1102	-	Programming Fundamentals	3	1	4
BCS-1103		Discrete Structures	3	0	3
MAT-1115	-	Calculus and Analytical Geometry	3	0	3
ENG-1107	-	English Composition & Comprehension	3	0	3
		<b>Total:</b>	<b>14</b>	<b>2</b>	<b>16</b>

#### Semester-2

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-1201	BCS-1102	Object Oriented Programming	3	1	4
BCS-1202		Database Systems	3	1	4
MAT-1215	MAT-1115	Linear Algebra	3	0	3
STA-1220		Statistics and Probability	3	0	3
ENG-1207	ENG-1107	Communication Skills	3	0	3
		<b>Total:</b>	<b>15</b>	<b>2</b>	<b>17</b>

#### Semester-3

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-2301	BCS-1102	Data Structure and Algorithms	3	1	4
BCS-2302		Information Security	3	0	3
BAI-2303	BCS-1201	Artificial Intelligence	3	1	4
BCS-2304		Digital Logic Design	3	1	4
MAT-2315	MAT-1115	Differential Equations	3	0	3
		<b>Total:</b>	<b>15</b>	<b>3</b>	<b>18</b>

#### Semester-4

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-2401		Computer Networks	3	1	4
MSG-2402	BCS-2304	Micro Processor and Assembly Language	3	1	4
BCS-2403	BCS-2301	Design and Analysis of Algorithms	3	0	3
BAI-2404	BAI-2303	Programming for AI	2	1	3
BCS-2405		Theory of Automata	3	0	3
		<b>Total:</b>	<b>14</b>	<b>3</b>	<b>17</b>

**Semester-5**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BAI-3502	BAI-2404	Artificial Neural Networks	2	1	3
BAI-3503	BAI-2404	Machine Learning	2	1	3
BAI-3504	BAI-2404	Knowledge Representation and Reasoning	3	0	3
BAI-3505		Agent based Modelling	3	0	3
ARA-3501		Arabic	3	0	3
		<b>Total:</b>	<b>13</b>	<b>2</b>	<b>15</b>

**Semester-6**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BAI-3602	BAI-3502	Computer Vision	2	1	3
BAI-3603	BAI-3502	Fuzzy Systems	3	0	3
BAI-3604		Natural Language Processing	3	0	3
BAI-3605		Data Mining	2	1	3
HRM-3609		Human Resource Management	3	0	3
		<b>Total:</b>	<b>13</b>	<b>2</b>	<b>15</b>

**Semester 7**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-4701		Final Year Project	0	2	2
BCS-4702	BCS-2301	Operating Systems	3	1	4
BCS-4703		Software Engineering	3	0	3
PSY-4719		Psychology	3	0	3
ENG-4707		Technical and Business Writing	3	0	3
ISL-4712		Islamic Studies	2	0	2
		<b>Total:</b>	<b>14</b>	<b>3</b>	<b>17</b>

**Semester-8**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-4801		Final Year Project	0	4	4
BCS-4802	BCS-1201	Parallel & Distributed computing	2	1	3
MGS-4803		Financial Accounting	3	0	3
HUM-4804		Professional Practices	3	0	3
PS-4817		Pakistan Studies	2	0	2
		<b>Total:</b>	<b>10</b>	<b>5</b>	<b>15</b>

Note: Course Contents available separately

### 3.9 BS Cyber Security

The BS (CySec) program intended to produce skilled professionals to understand the processes that impact information security, safeguarding information assets, collection and preservation of digital evidences, analysis of data, and identification and fixing of security vulnerabilities. The program will equip students with the fundamental knowledge of computer science that forms the technical foundation of the field, with an essential focus on experiential learning through laboratory exercises in the security courses. This degree is a state-of-the-art course with a perfect blend of Cyber Security that is designed to set the graduates up for immediate industry success by combining and leveraging today's cutting-edge technology with real-world scenarios.

### 3.10 Proposed Curriculum for BS (Cyber Security)

Following are the proposed areas which are required to cover to complete the degree. Covered areas consist of core courses (compulsory), foundation courses, general courses and electives.

#### Areas Covered in BS(CySec)

<b>Course Group</b>	<b>Credit hours</b>	<b>Min No of Courses</b>
General Education	19	7
University Electives	12	4
Mathematics & Science Foundation	12	4
Computing – Core	39	11
Computer Science Core	18	5
CySec Core (Domain Core)	18	6
CySec Electives (Domain Electives)	12	4
<b>TOTAL</b>	<b>130</b>	<b>41</b>

### 3.11 Proposed Study Plan for BS (Cyber Security)

4-Year Program (8 Regular Semesters of 18 weeks each)

#### Semester-1

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-1101	-	Introduction to ICT	2	1	3
BCS-1102	-	Programming Fundamentals	3	1	4
BCS-1103		Discrete Structures	3	0	3
MAT-1115	-	Calculus and Analytical Geometry	3	0	3
ENG-1107	-	English Composition & Comprehension	3	0	3
		<b>Total:</b>	<b>14</b>	<b>2</b>	<b>16</b>

#### Semester-2

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-1201	BCS-1102	Object Oriented Programming	3	1	4
BCS-1202		Database Systems	3	1	4
MAT-1215	MAT-1115	Linear Algebra	3	0	3
STA-1220		Statistics and Probability	3	0	3
ENG-1207	ENG-1107	Communication Skills	3	0	3
		<b>Total:</b>	<b>15</b>	<b>2</b>	<b>17</b>

#### Semester-3

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-2301	BCS-1102	Data Structure and Algorithms	3	1	4
BCS-2302		Information Security	3	0	3
BAI-2303	BCS-1201	Artificial Intelligence	3	1	4
BCS-2304		Digital Logic Design	3	1	4
MAT-2315	MAT-1115	Differential Equations	3	0	3
		<b>Total:</b>	<b>15</b>	<b>3</b>	<b>18</b>

#### Semester-4

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-2401		Computer Networks	3	1	4
MSG-2402	BCS-2304	Micro Processor and Assembly Language	3	1	4
BCS-2403	BCS-2301	Design and Analysis of Algorithms	3	0	3
BCY-2404	BCS-2302	Introduction to Cyber Security	3	0	3
BCY-2405		Hardware Security	3	0	3
		<b>Total:</b>	<b>14</b>	<b>3</b>	<b>17</b>

**Semester-5**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCY-3502	BCY-2404	Digital Forensics	2	1	3
BCY-3503		Information Assurance	3	0	3
BCY-3504	BCY-2404	Network Security	2	1	3
BCY-3505		Wireless and Mobile Security	3	0	3
ARA-3501		Arabic	3	0	3
		<b>Total:</b>	<b>13</b>	<b>2</b>	<b>15</b>

**Semester-6**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCY-3602	BCY-2404	Secure Software Design and Dev.	2	1	3
BCY-3603	BCY-2404	Vulnerability Assessment & Reverse Engineering	2	1	3
BCY-3604		Cyber Law & Cyber Crime	3	0	3
BCY-3605		Cryptanalysis	3	0	3
HRM-3609		Human Resource Management	3	0	3
		<b>Total:</b>	<b>13</b>	<b>2</b>	<b>15</b>

**Semester 7**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-4701		Final Year Project (1)	0	2	2
BCS-4702		Software Engineering	3	0	3
BCS-4701	BCS-2301	Operating Systems	3	1	4
PSY-4719		Psychology	3	0	3
ENG-4707		Technical and Business Writing	3	0	3
ISL-4712		Islamic Studies	2	0	2
		<b>Total:</b>	<b>14</b>	<b>3</b>	<b>17</b>

**Semester-8**

Code	Pre-Req	Title	Lec. Hrs	Lab. Hrs	Credit Hours
BCS-4801		Final Year Project (2)	0	4	4
BCS-4802	BCS-1201	Parallel & Distributed computing	2	1	3
MGS-4803		Financial Accounting	3	0	3
HUM-4803		Professional Practices	3	0	3
PS-4817		Pakistan Studies	2	0	2
		<b>Total:</b>	<b>10</b>	<b>5</b>	<b>15</b>

Note: Course Contents available separately