BS (Computer Science) Program

BS (Computer Science) is a 4-year degree program that combines a solid core of theoretical Computer Science courses and a range of applied courses to inculcate problem solving skills in students and to make them ready for the challenges of the practical life. The program consists of 137 credit hours out of which 62 are core CS courses while 36 are from supporting disciplines (Maths, Physics and General Education). In addition to these core requirements, students are allowed to take electives from a wide range of CS courses including but not limited to Enterprise Resource Planning, Supply Chain Management, Social Computing, Introduction to Robotics, Game Programming, Data Warehousing, Distributed Systems, E-Commerce, Software Project Management, etc. This wide selection of courses gives students enough flexibility to pursue a career path of their choice.

In addition, the availability of numerous humanities and management science courses and the prevailing culture at IBA which strongly encourages students to actively participate in a wide-range of student bodies help in developing a well-rounded personality in our students. As CS/IT graduates are required to closely work with members of other professions, this breadth-based approach makes sure that students have enough understanding of the issues they will face after graduation. The placement of IBA BS(CS) graduates in top software houses, financial institutions, business solution providers and multi-national corporations is a living proof of the success of this philosophy.

"The difference between fiction and reality? Fiction has to make sense ."
-Tom Clancy

"For every sin but the killing of time there is forgiveness."
- Traditional Sufism

BS(CS) Course Structure

Required Courses

Section	Knowledge Area	Credit Hours
A	Core Courses	62
B	Supporting Sciences	21
C	General Education	15
D	Computer Science Electives	21
E	General Electives	18
	Total	137

Please note that these are minimum credit requirements.
Further credit requirements may be added in due course of the program.

A. Core Courses

Course Title	Course Code	Total Credit Hours
Introduction to Programming	CSE141	4
Object Oriented Programming Techniques	CSE142	4
Introduction to Computing	CSE145	4
Numerical Analysis and Algorithms (Analysis of Algorithms)	CSE202	3
Digital Logic Design (DL and Computer Arch)	CSE241	4
Data Communications and Networking	CSE243	4
Data Structures and Algorithms	CSE246	4
Introduction to Artificial Intelligence	CSE307	3
Theory of Automata	CSE309	3
Computer Architecture and Assembly Language	CSE310	3
Software Engineering (Introduction to Software Development)	CSE312	3
System Programming	CSE315	3
Numerical and Symbolic Computation	CSE316	3
Database Systems	CSE341	4
Operating Systems	CSE342	4
Computer Science Project (I & II)	CSE491 & 492	6
Logic and Discrete Structures	MTS 201	3

B. Supporting Science

Course Title	Course Code	Total Credit Hours
Calculus-I (Calculus and Analytical Geometry)	MTS101	3
Introduction to Statistics (Probability and Statistics)	MTS102	3
Linear Algebra	MTS203	3
Calculus-II (Multivariate Calculus)	MTS232	3
Differential Equations	MTS401	3
Physics - I (Electromagnetism)	SCI105	3
Physics - II (Mechanics)	SCI205	3

C. General Education

Course Title	Course Code	Total Credit Hours
Business Communication	MGT211	3
Technical Report Writing	MIS202	3
Audit, Ethics & IS Issues	MIS454	3
English Composition	SSC101	3
One course from Group I	SSCXXX	3

D. Computer Science

Course Title	Course Code	Total Credit Hours
Object Oriented Design and Implementation	CSE311	3
Compiler Design	CSE344	4
Microprocessor Interfacing	CSE448	4
Introduction to Game Programming and Robotics	CSE460	3
Software Project and Quality Management	MIS305	3
Datawarehousing	MIS343	4
Social Computing	MIS406	3
E-Commerce	MIS456	3
Enterprise Resource Planning	MIS458	3
Customer Relationship Management	MIS459	3
SAP ABAP Programming-I	MIS541	4
SAP ABAP Programming-II	MIS542	4
Logistic and Supply Chain Management	MIS550	3

Recommended Courses (not limited to the list above)

E. General Electives

Course Title	Course Code	Total Credit Hours
Principles of Accounting I	ACC111	3
Principles of Microeconomics	ECO103	3
Principles of Macroeconomics	ECO113	3
Introduction to Business Finance	FIN201	3
Principles of Management	MGT201	3
Principles of Marketing	MKT201	3
Social Psychology and Self Development	SSC103	3
Foreign Language (French, German, etc.)	SSCXXX	3

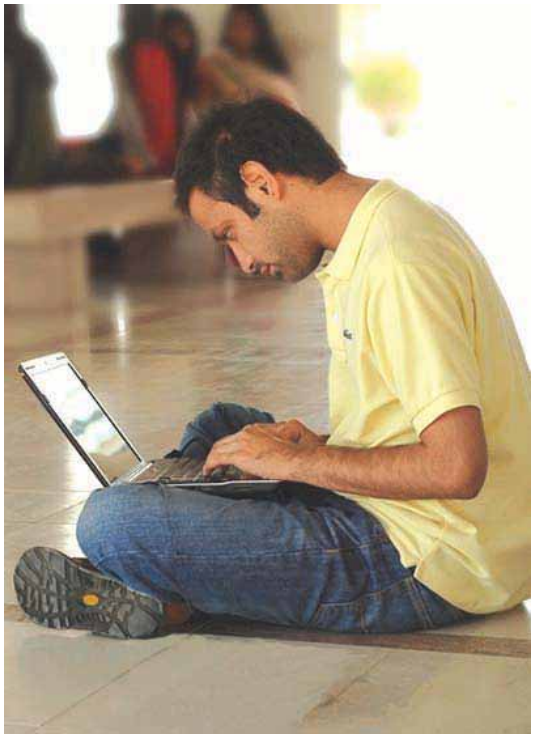
Group I Courses

Course Title	Course Code	Total Credit Hours
International Relations	HUM131	3
Pakistan's History	SSC151	3
General History	SSC152	3
English Literature	SSC112	3

BS Program

CSE141 Introduction to Programming (3,1,4)
This is a first of a series of programming based courses. It introduces fundamental problem solving skills and algorithm development with the help of a programming language. It covers topics like Variables & Data Types, Selection and Iteration Structures, Methods and Recursive Methods, Arrays and Structures, File I/O and optionally elementary 2D Graphics based on certain toolkits. It also covers flowchart design and pseudo-code approaches for representing solution to problems as well as debugging and testing techniques. Many programming languages support the required functionalities for this course. Spring and Fall.
Prerequisite: None

CSE142 Object Oriented Programming Techniques (3,1,4)
This course describes another paradigm as a better replacement for structured/procedural programming paradigm (CSE141) for managing large programs to segregate code into reusable chunks called classes. Principles of Abstraction, Encapsulation, Inheritance and Polymorphism are explored as well as developing an understanding of code structuring and design philosophies. It requires a thorough understanding of fundamentals of programming. Topics include class definition, constructors, destructors, access control, method overloading and overriding, inheritance, static and dynamic binding, exception handling, object life cycle and garbage collection, and namespaces. Either Java, C+ or C++ is used as a tool for implementation of concepts learnt in this course. Spring and Fall.
Prerequisite: CSE141, CSE145



CSE145 Introduction to Computing
This course takes a breadth-wise approach to different areas in the discipline of computer science. It overviews topics from number representation, hardware architecture, operating systems, databases, some computing models, languages and grammars, software development and engineering, networking and graphics. Java or C is used to demonstrate certain concepts. Spring and Fall.
Prerequisite: None

CSE208 Digital Logic Design (3,0,3)
This course introduces basic concepts of digital computer logic including switching logic, combinational circuits, minimization methods, adders, comparators, multiplexers, synchronous and asynchronous sequential circuits, registers, counters, flip flops, encoders, decoders, buffers, RAM, switches, PLDs, instruction set design, processor implementation techniques, serial and parallel arithmetic units, pipelining, and memory hierarchy. Fall.
Prerequisite: CSE145, MTS201

CSE209 Numerical Analysis & Algorithms (3,0,3)
This course introduces concepts and analysis of numerical methods. Topics covered are solutions of nonlinear equations (interval-halving, linear interpolation, Newton, Fixed point, etc.), Interpolating polynomials, various types of differences, representation of polynomials by difference operators and their relation, symbolic derivation, interpolation with unequal intervals, inverse interpolation, 2nd and 3rd dimensional interpolations, numerical differentiation and integration. Fall.
Prerequisites: CSE246, MTS203

CSE243 Data Communication and Networking (3,1,4)
This is an introductory course in data communications and networking. It is a 4 credit course comprising of 3 hours of theory and 3 hours of lab teaching per week. It familiarizes the students with the techniques, applications and control of modern data communications networks. Topics included are network models, digital and analog transmission, multiplexing, circuit and packet switching, LAN, WLAN and WAN Networks. Spring
Prerequisite: None

CSE246 Data Structures and Algorithms (3,1,4)
The purpose of this course is to provide students a solid foundation in the basic concepts of programming: data structures and algorithms. Students are taught how to select and design data structures and algorithms that are appropriate for problems that they might encounter. The course focuses on comparing algorithms and studying their correctness and computational complexity. Students are provided a mixture of theoretical knowledge and practical experience using any programming language (C, C++, C# or JAVA). Other topics covered in the course include analysis of algorithms, primitive types, arrays, stack, queues, recursion, link list, trees, binary search trees, multi-way search trees, priority queues and graphs, sorting, searching, and hash table. Spring and Fall.
Prerequisites: CSE142, MTS201

CSE307 Introduction to Artificial Intelligence (3,0,3)
This course provides an overview of the theoretical and practical aspects of designing intelligent computer systems. Students are expected to implement the concepts learned during the course using standard and AI-specific programming languages and tools. Topics included are history and overview of artificial intelligence, state space representation, uninformed and informed search techniques, search in games, decision trees, neural networks, evolutionary algorithms, propositional and predicate logic, inference in logic, probabilistic reasoning, robotics and various machine learning and computational intelligence techniques. Spring.
Prerequisites: CSE246, MTS201

CSE309 Theory of Automata (3,0,3)
This course is about the theoretical foundations of computer science. Mathematical and abstract computational models are explored with special reference to the theory of programming languages. Topics include Kleene's Closure, Regular Expressions and Languages, Deterministic and Non-Deterministic Automata, Transition Graphics, Context Free Grammars and Derivations, Push-Down Automata and Pumping Lemma, Turing Machines and other equivalent machines, and Chomsky Hierarchy of Languages. The domains and limitations of each computational model are also explored. Fall.

CSE310 Computer Architecture & Assembly Language (3,0,3)
This course is an introduction to computer system structure and organization. Topics include representation of information, processor architecture, input/output, CPU, ALU, memory hierarchy, arithmetic circuits, micro and macro instructions, arithmetic shifts, overflow and underflow situations, fixed point and floating point data, instruction codes, super scalar structures, VLIW, and other modern CPU architectures. Spring
Prerequisites: CSE141,CSE208

CSE311 Object Oriented Design and Implementation (3,0,3)
This course is an advancement of the techniques learnt in Object Oriented Programming. Topics include Conceptual and Object Modeling, Functional Requirements for a system and produces implementation specifications. Unified Modeling Language is used for representing various phases of analysis and design.
Prerequisites: CSE142, CSE246

CSE312 Software Engineering (3,0,3)
This course introduces students to the fundamental principles and methodologies of large-scale software development. Students learn about the theory and practice of software engineering. It requires a programming background. Students apply the taught practices on their individual programming effort to identify their strengths and shortcomings through the use of Personal Software Process (PSP). Additionally, they work as part of a team on a full lifecycle software project that includes planning, software specification, software design, coding, inspections, and testing. Spring
Prerequisite: CSE246

CSE341 Database Systems (3,1,4)
The course covers the foundations of database systems, database management systems and the design and implementation of database systems using industries top DBMS such as Oracle, SQL Server, etc. Topics included are fundamentals of database architecture, focusing on basics such as the relational algebra and data model, deriving a physical design from the logical design, schema normalization & denormalization, data security, data integrity, query optimization, transactions management,

and introduction to distributed databases, object oriented databases and data warehousing. Spring
Prerequisite: CSE246

CSE342 Operating Systems (3,1,4)
The objective of this course is to introduce the organization of operating systems. Topics included are process management and scheduling, interaction of concurrent processes, interrupts, I/O, device handling, memory and virtual memory management and file management. A survey is carried out of the design and implementation of distributed operating systems, both by introducing basic concepts and considering examples of current systems: UNIX and recently developed operating systems such as Linux, Vista are presented. Fall
Prerequisites: CSE246, CSE310

CSE344 Compiler Design (3,1,4)
This course examines the design consideration, constraints and implementation techniques for developing compilers and interpreters. Programming language code translation issues are explored with reference to problem domains, resource requirements and runtime requirements. Topics include Compiler Backend Operations like Scanning, Parsing (top-down and bottom-up parsing), BNF/EBNF and Syntax Trees, Semantic Analysis and Annotated Grammars, and Compiler Frontend Operations like Runtime Environments, Code Generation and Introduction to Code Optimization.
Prerequisites: CSE310, CSE309

CSE406 Principles of Programming Languages
This course develops understanding of programming language design and implementation issues with respect to computational models their domains and ease of use. It covers topics like data types, declarations, static and dynamic binding, evaluation order, scopes and lifetimes, evaluation order and interpretation and compilation as well as just in time compilation. A comparison of fundamental characteristics of structured, scripting, logical and functional languages is also drawn.
Prerequisite: CSE142

CSE443 Modeling & Simulation (3,1,4)
This course looks at simulation, which is one of the most widely adopted techniques in problem solving. It includes an overview of system modeling and simulation, manual example on simulation of discrete event individual life and health insurance, regulation, and insurer operations and functions.

CSE448 Microprocessor Interfacing (3,1,4)
This course covers the fundamentals of Intel x86 assembly language and the basic architecture of the Intel microprocessor. Topics include assembly language, microcomputer system hardware, input / output devices, and bus discipline. In addition, 8051 Microcontroller Programming and Interfacing will also be covered. This course consists mostly of hardware labs in which students develop projects on electronics, leading to a final semester project.
Prerequisite: CSE310

CSE455 Network Security (3,0,3)
Students are introduced to the security issues in computing, communications, and electronic commerce. The course covers security requirements and vulnerabilities, legal and ethical issues, basic cryptology, private and authenticated communication, electronic commerce security, software security, viruses and other malicious codes, operating system protection, trusted systems design, network security, firewalls, auditing, physical security and disaster recovery.
Prerequisite: CSE243

CSE460: Introduction to Game Programming and Robotics (3,0,3)
The course introduces the fundamentals of game programming and robotics. This is a programming intensive course and students are required to spend a significant amount of time in developing interactive games and creating virtual simulation environments to be used in conjunction with robots. Students will get hands on experience of XNA Studio Express, Microsoft Robotics Development Studio, and Lego Robots. The main focus of the course is on the processes, algorithms, and mathematics necessary to create 3D computer games and to build autonomous robots for various tasks. The course provides great opportunity to students to expand their programming and engineering skills even if they are not interested in pursuing careers in robots or video games development.
Prerequisite: CSE142 and CSE307

CSE491 Computer Science Project I (0,3,3)
This is a two semester development project under faculty supervision. Students may propose their own projects for departmental approval or may apply for a project proposed by a faculty member. Spring and Fall.
Prerequisites: CSE311, CSE312, CSE341

CSE492 Computer Science Project II (0,3,3)
This is the second part of Computer Science Project to be taken after the successful completion of Computer Science Project-I Spring and Fall.
Prerequisite: CSE491

MIS202 Technical Report Writing (3,0,3)
Topics covered in this course include a study of the particular requirements of technical report writing, coupled with a review and refinement of basic grammar and composition skills. Students will be taught about the research process and analytical reports: how to gather, analyze, and organize data for writing a formal research report on an identified and approved business-related topic, write references using required MLA or APA styles, and document design. Fall.
Prerequisite: MGT211

MIS343: Datawarehousing (3,1,4)
This course is a study of the techniques for planning, designing, building, populating, and maintaining a successful datawarehouse. The data warehouse continues to be one of the most organizationally complex and technically interesting projects in Information Technology. This course provides students an in-depth knowledge of the different phases of building data warehouse. Throughout the course, the special focus is given to the practical aspects of dimensional modeling, ETL, Data Quality and cleansing, and decision support through OLAP.

MIS406: Social Computing (3,0,3)
The course focuses on the emerging area of 'Social Computing', which is becoming quite popular and important these days within the discipline of Information Systems. As information systems are becoming more social, Information Systems increasingly require both social and technological perspectives. Social computing hinges on this intersection of social and computer sciences. This course's pedagogy also reflects this new paradigm and is not teacher centric. Rather it is collaborative learning, where peers learn from each other and the role of the teacher becomes that of a guide, resource person and moderator. The students make use of a class wiki as their collaborative learning platform. Typical topics covered include; network theory, theories of social influence, analysis and design of social online environments, blogosphere, business applications of social computing, collective intelligence, computer supported cooperative work, folksonomies, prediction markets, recommender systems, reputation management systems, social collaboration, social network analysis and visualization, tagging, virtual communities of practice, wiki technology and culture.

MIS454 Audit, Ethics & IS Issues (3,0,3)
The course analyzes the impact of computers on society. Topics included are privacy issues, changing patterns of interaction, security, control of information systems, breakdowns, vulnerability, hazards, computer crimes, fraud, defenses, access controls, audit planning and execution, disaster recovery and risk management.
Prerequisite: MIS102

MIS458 Enterprise Resource Planning (3,0,3)
Now a days the corporate world is moving towards ERP Implementations. ERP has become the backbone of modern corporate world and it is hard to imagine a corporation without ERP. The ERP course will give the students a clear understanding what is ERP and what is does and what are the issues in the organizations that lead toward ERP implementation. The ERP course will cover areas such as Fundamental Concepts about ERP, Major ERP Vendors, ERP Selection Process (including ERP Business case development, Business Requirement definition, ERP Budgeting, Request for Proposal and ERP Vendor demos and ERP selection criteria), and Project Management and Information flows in ERP. The course will also cover the overview of SAP modules (Sales and Distribution, Material Management, Production and Supply Chain Management). The Students are required to do presentations and conduct surveys about ERP related topics. A term report will also be submitted at the end of the Semester.

MIS550 Logistic & Supply Chain Management (3,0,3)
Logistics is one of the most important aspect of supply chain and its importance is growing rapidly as the world is moving towards globalization. After completing this course the students will have a clear understanding what is supply chain management and the role of logistics in the modern supply chain paradigm. The course is specifically designed for students who are proactive in their work style and want to sharpen their problem solving and solution designing skills. The students will learn how to identify issues / problems and develop solutions in the areas such as procurement management, supplier management, inventory handling, warehouse management, logistics etc. The course will cover areas such as understanding the supply chain, purchasing management, supplier

management, strategic sourcing , demand forecasting and collaborative planning, inventory management & bull-whip effect (SCM game), domestic and international transport, logistics outsourcing (3pl and 4pl), designing the transport network, performance measurement along the supply chain. A term report will also be submitted at the end of the semester.

MTS101 Calculus-I (3,0,3)
Topics included are real and complex numbers, absolute values, average rate of change of a function, the derivative of a function, the differential of a function, rectangular coordinates, functions and graphs, limits and continuity functions, higher derivatives, differentiation of algebraic functions, applications of derivatives, fundamental theorems of differential calculus and techniques of integration, and 1st and 2nd order differential equations. Spring and Fall
Prerequisite: MTS105

MTS102 Introduction to Statistics (3,0,3)
The course content includes: types of data, frequency distributions, measures of central tendency and dispersion, exploratory data analysis, introduction to set and probability theory, events and laws of probability, independence, conditional probability, discrete random variables, Binomial and Poisson distributions, index numbers and time series, introduction to MINITAB (the statistical software). Spring
Prerequisite: MTS105

MTS201 Logic & Discrete Structures (3,0,3)
This course teaches topics of logic, propositional equivalences, predicate and quantifiers, sets, relations, functions, sequences and series, the growth of functions and complexity algorithms, the integers and division, matrices, methods of proof, mathematical induction, recursive relations, generation functions the basics of counting, the pigeonhole principle, permutations and combinations, discrete probability, graphs, graph isomorphism, connectivity, Euler and Hamilton paths, introduction to trees, Boolean functions, logic gates and minimization of circuits. Spring
Prerequisite: MTS105

MTS203 Linear Algebra (3,0,3)
This course familiarizes students with binary operations, groups, rings and fields, vector spaces, linearly dependent and independent vectors, linear transformations, matrices of linear transformations, properties of matrices, matrix algebra, elementary row/column operations, Echelon form, normal form, rank and inverse of matrices, solution of equations, consistency criteria, elimination method and Gauss Jordan method, determinants and their properties, Cramer's rule and computations through MATLAB. Spring.
Prerequisite: MTS105

MTS232 Calculus-II (3,0,3)
This course covers topics of definite integrals, improper integrals, Laplace transformations, infinite sequences, Fourier Series, curves in two dimensions, three dimensional geometry, gradient, divergence and curl, directional derivatives and theorems of Gauss & Green. Spring.
Prerequisite: MTS 131

MTS401 Differential Equations
This is an advanced course on differential equations. The objective of the course is to impart knowledge about the bits and pieces that help in understanding the different areas of computer science. It is a 3 credit course comprising of 3 hours of theory teaching per week. Topics included are analytic, numerical, and qualitative analysis of ordinary differential equations, linear equations, linear and non-linear systems, application to mechanics, biology, physics, and the social sciences. Existence and uniqueness of solution and visual analysis using computer graphics is a part of this course. Topics selected from Laplace transforms, power series solutions, chaos, and numerical solutions are taught as well. Fall.
Prerequisite: MTS232

SCI105 Physics- I (Electromagnetism) (3,1,4)
The contents of this course includes vectors, mechanics of particles, Newton's laws of motion, work, energy, and power, impulse and momentum, conservation laws, mechanics of rigid bodies, rotation, equilibrium, fluids, heat, thermodynamics, periodic motion, electricity and magnetism, Coulomb's law, electric fields, potential capacitance, resistance, D.C. circuits, magnetic fields, fields due to currents, induction, magnetic properties, wave motion, vibration and sound, interference, and light are also covered. Spring and Fall.