# Scheme of Study for Bachelor of Science in Information Technology BS (IT)

**4-year Programme (8 Semesters)**

| # | Category | | Credit Hours |
|---|---|---|---|
| **1** | **Computing Courses** | | **67** |
| | Core Courses | 37 | |
| | Supporting Areas | 12 | |
| | General Education | 18 | |
| **2** | **Information Technology Courses** | | **48** |
| | IT Core Courses | 18 | |
| | IT Electives Courses | 21 | |
| | IT Supporting Courses | 9 | |
| **3** | **University Electives** | | **21** |
| | **Total Credit Hours** | | **136** |

**Semester I: (18 credit hours)**

| *#* | *Course code* | *Course Title* | *Category* | *Credit Hours* | *Prerequisites* |
|---|---|---|---|---|---|
| 1 | IT 101 | Introduction to Information and Comm. Technologies | Computing General Education | 2+1 | - |
| 2 | CS 103 | Programming Fundamentals | Computing core course | 3+1 | - |
| 3 | MT 105 | Calculus and Analytical Geometry | Computing Supporting course | 3+0 | - |
| 4 | EE 107 | Basic Electronics | Computing Supporting course | 2+1 | - |
| 5 | EG 109 | English Composition & Comprehension | Computing General Education | 3+0 | - |
| 6 | * 111 | University Elective I | University Electives | 3+0 | - |

**Semester II: (17 credit hours)**

| *#* | *Course code* | *Course Title* | *Category* | *Credit Hours* | *Prerequisites* |
|---|---|---|---|---|---|
| 1 | CS 102 | Discrete Structures | Computing core course | 3+0 | - |
| 2 | CS 104 | Object Oriented Programming | Computing core course | 2+1 | Programming Fundamentals |
| 3 | IT 106 | Fundamentals of IT | IT core course | 3+0 | - |
| 4 | * 108 | University Elective II | University Electives | 3+0 | - |
| 5 | EG 110 | Communication Skills | Computing General Education | 3+0 | - |
| 6 | PK 112 | Pakistan Studies | Computing General Education | 2+0 | - |

**Semester III: (17 credit hours)**

| # | *Course code* | *Course Title* | *Category* | *Credit Hours* | *Prerequisites* |
|---|---|---|---|---|---|
| 1 | CS 201 | Digital Logic Design | Computing core course | 2+1 | Discrete Structures |
| 2 | CS 203 | Data Structures and Algorithms | Computing core course | 2+1 | Programming Fundamentals |
| 3 | MT 205 | Linear Algebra | Computing Supporting course | 3+0 | - |
| 4 | EG 207 | Technical and Business Writing | Computing General Education | 3+0 | - |
| 5 | PK 209 | Islamic Studies/Ethics | Computing General Education | 2+0 | - |
| 6 | * 211 | University Elective III | University Electives | 3+0 | - |

**Semester IV: (18 credit hours)**

| # | *Course code* | *Course Title* | *Category* | *Credit Hours* | *Prerequisites* |
|---|---|---|---|---|---|
| 1 | CS 202 | Operating Systems | Computing core course | 2+1 | - |
| 2 | CS 204 | Introduction to Database Systems | Computing core course | 2+1 | Data Structures and Algorithms |
| 3 | IT 206 | Organizational Behaviour | IT supporting course | 3+0 | - |
| 4 | MT 208 | Probability and Statistics | Computing supporting course | 3+0 | - |
| 5 | CS 210 | Computer Communication and Networks | Computing core course | 2+1 | - |
| 6 | * 212 | University Elective IV | University Electives | 3+0 | - |

**Semester V: (18 credit hours)**

| # | *Course code* | *Course Title* | *Category* | *Credit Hours* | *Prerequisites* |
|---|---|---|---|---|---|
| 1 | IT 301 | Web Systems and Technologies | IT core course | 2+1 | Fundamentals of IT |
| 2 | * 303 | University Elective V | Computing core course | 3+0 | - |
| 3 | CS 305 | Introduction to Software Development | Computing core course | 3+0 | Data Structures and Algorithms |
| 4 | * 307 | IT Elective I | IT Electives | 3+0 | - |
| 5 | IT 309 | Multimedia Systems and Design | IT core course | 2+1 | Fundamentals of IT |
| 6 | IT 311 | Information Systems | IT supporting course | 3+0 | - |

**Semester VI: (18 credit hours)**

| # | *Course code* | *Course Title* | *Category* | *Credit Hours* | *Prerequisites* |
|---|---|---|---|---|---|
| 1 | * 302 | University Elective VI | University Electives | 3+0 | - |
| 2 | IT 304 | Systems and Network Administration | IT core course | 2+1 | - |
| 3 | * 306 | IT Elective II | IT Electives | 3+0 | - |
| 4 | * 308 | University Elective VII | University Electives | 3+0 | - |
| 5 | * 310 | IT Elective –III | IT Electives | 3+0 | - |
| 6 | CS 312 | Human Computer Interaction | Computing core course | 2+1 | - |

**Semester VII: (18 credit hours)**

| # | *Course code* | *Course Title* | *Category* | *Credit Hours* | *Prerequisites* |
|---|---|---|---|---|---|
| 1 | - | IT Capstone Part I (continued) | Computing core course | --- | - |
| 2 | IT401 | Technology Management | IT supporting course | 3+0 | - |
| 3 | * 403 | IT Elective IV | IT Electives | 3+0 | - |
| 4 | IT 405 | Network Security | IT core course | 3+0 | - |
| 5 | IT 407 | System Integration and Architecture | IT core course | 3+0 | Fundamentals of IT |
| 6 | * 409 | IT Elective V | IT Electives | 3+0 | - |

**Semester VIII: (15 credit hours)**

| # | *Course code* | *Course Title* | *Category* | *Credit Hours* | *Prerequisites* |
|---|---|---|---|---|---|
| 1 | CS 402 | IT Capstone Part II | Computing core course | 6 | - |
| 2 | * 404 | IT Elective VI | IT Elective | 3 | - |
| 3 | SS 406 | Professional Practices | Computing General education | 3 | - |
| 4 | * 408 | IT Elective VII | IT core course | 3 | - |

* **Note:** The prefix of the courses can be selected from the detailed IT and university electives based on the category they belong to; i.e. CS, IT, MT, SS, EG, PK etc.

## Electives for BS (IT):
## IT Elective courses:

| # | *Course code* | *Course Title* | *Category* | *Credit Hours* | *Prerequisites* | *Semester* |
|---|---|---|---|---|---|---|
| 1. | IT | Mobile and Pervasive Computing | IT Elective | 3 | - | 8 |
| 2. | IT | Engineering Intelligent systems | IT Elective | 3 | Object Oriented Paradigm | 7 |
| 3. | IT | Data Warehousing and Mining | IT Elective | 3 | Intro. to database system | 6 |
| 4. | IT | Computer Architecture | IT Elective | 3 | - | 7 |
| 5. | IT | Telecommunication System | IT Elective | 3 | - | 5 |
| 6. | IT | Distributed Computing | IT Elective | 3 | Fundamentals of IT | 7 |
| 7. | IT | Distributed Database System | IT Elective | 3 | Intro. to database system | 7 |
| 8. | IT | Visual Programming | IT Elective | 3 | Programming Fundamentals | 5/6 |
| 9. | IT | Service Oriented Architectures | IT Elective | 3 | Web System and Technologies | 8 |
| 10. | IT | RDBMS using Oracle | IT Elective | 3 | Intro. to database system | 8 |
| 11. | IT | Advance Object Oriented Programming using Java | IT Elective | 3 | Programming Fundamentals | 5/6 |
| 12. | IT | IT Project Management | IT Elective | 3 | - | 6 |

## University Elective courses:

| # | *Course code* | *Course Title* | *Category* | *Credit Hours* | *Prerequisites* | *Semester* |
|---|---|---|---|---|---|---|
| 1. | MG | Entrepreneurship | Uni. Elective | 3 | - | 6 |
| 2. | MG | Human Resource Management | Uni. Elective | 3 | - | 3 |
| 3. | MG | Strategic Information Management | Uni. Elective | 3 | - | 4 |
| 4. | MG | Total Quality Management | Uni. Elective | | - | 6 |
| 5. | MG | Financial Accounting | Uni. Elective | | | 2 |
| 6. | SS | Economics | Uni. Elective | 3 | - | 1 |
| 7. | SS | International Relations | Uni. Elective | 3 | - | |
| 8. | SS | Psychology | Uni. Elective | 3 | - | 5 |
| 9. | SS | Philosophy | Uni. Elective | 3 | - | |

# Course outline for IT Electives

**Course Name: Engineering Intelligent systems**
**Credit Hours:** 3
**Prerequisites:** Programming Fundamentals, Object Oriented Paradigm
**Objectives:**
The course aims to provide students an introduction to the concept of Multi-agent Systems and to relate it with the engineering and development of the intelligent systems. The main focus of this course will be the, study of major topics in the domain of Multi-agent systems and discuss the problems associated with such systems. The objective includes exposure of myths and realities about Multi-agent systems and how the evolution took place from engineering Object Oriented development to Multi-agent Systems. The aim is to acquaint students with the techniques to design and develop Multi-agent systems.

**Course Outline:**
Overview of Multi-agent Systems, characteristics, requirements of agents, methods for agent based system modeling and design, agent communication, ontologies, interaction and negotiations in Multi-agent systems, agent applications, standard governing bodies for Multi-agent development, and engineering techniques for Multi-agent systems.

**Suggested Text Books:**

- An Introduction to Multi-agent Systems by Michael Wooldridge Paperback
- Multi-agent Systems: A Modern Approach to Distributed Artificial Intelligence by Gerhard Weiss
- Multi-agent Systems: Algorithmic, Game-Theoretic, and Logical Foundations by Yoav Shoham

**Course Name**: **Data Warehousing and Data Mining**
**Course Structure**: 3
**Prerequisites:** Introduction to Database systems

**Course Outline:**

Concepts of Data mining and Data Warehousing, Data Preparation Techniques: outlier and missing data analysis, Data Reduction Techniques, learning methods in Data mining, Statistical Methods in Data Mining, Cluster Analysis, hierarchal, agglomerative and Naïve Bayesian methods, Decision Trees and Decision Rules, Association Rules, Other Soft Computing Approaches in Data Mining, Artificial Neural Networks, Fuzzy Logic and Fuzzy Set Theory, Genetic Algorithm, evolutionary algorithms.

## Suggested Text Books


1. Mehmed Kantatardzic, Data Mning: Concepts, Models, Methods, and Algorithms, 2003, John Wiley and Sons.
2. Margaret H. Dunham and S. Sridhar, Data Mining, Introductory and Advanced Topics, 2006, Pearson Education,
3. David Hand, Heikki MAnnila and Padhraic Smyth, Principles of Data Mining, 2001, The MIT Press.
4. Daniel T. Larose, Data Mining Methods and Models, 2006, John Wiley and Sons.
5. Max Bramer, Principles of Data Mining, 2007, Springer-Verlag.
6. Paulraj Ponniah, Data Warehousing Fundamentals, 2005, John Wiley and Sons.


## Course Name: Computer Architecture

**Credit Hours:** 3

**Prerequisites:** Digital Logic and Design

**Objectives:**

Get a deeper understanding of how computers work, working knowledge of various subsystems and the general principles that affect their performance, analyze the performance of systems and quantify the performance measurements, fundamentals of all technologies, and advanced architectural features that boost the performance of computers.

**Course Outline:**

Fundamentals of Computer Design including performance measurements & quantitative principles, principles of Instruction Set Design, Operands, addressing modes and encoding, pipelining of Processors: Issues and Hurdles, exception handling features, Instruction-Level Parallelism and Dynamic handling of Exceptions, Memory Hierarchy Design, Cache Design, Performance Issues and improvements, Main Memory Performance Issues, Storage Systems, Multiprocessors and Thread Level Parallelism, case studies.

**Suggested Text Books:**


- Computer Architecture: A Quantitative Approach by Hennessy & Patterson, Morgan & Kauffman Series (2006) Fourth Edition.
- Computer Organization & Design: The Hardware/Software Interface by Patterson & Hennessy, Morgan & Kauffman Series (2008) Fourth Edition.


## Course Name: Telecommunication Systems

**Credit Hours:** 3

**Prerequisites:** None

**Objectives:**

To provide a first level exposure to the broad domain of telecommunication systems.

**Course Outline:**

Introduction to media, bandwidth and noise. Twisted pair (UTP, STP), coaxial cables (types and specifications), optical fibers (types and losses), Introduction to optical sources and detectors. Microwave links, satellite communication and infrared links. Frequency Division Multiplexing (FDM), TDM, FDMA, TDMA and CDMA. Switching: circuit and packet switching. Introduction to mobile and cellular communications. Block diagram and current trends.

**Suggested Text Books:**

- Introduction to Telecommunications Network Engineering, 2nd edition, T. Aattalainen, Artech House 2003, ISBN: 1580535003.
- Fundamentals of Telecommunication Networks, T. Saadawi, Wiley US, ISBN: 0471515825.
- Telecommunication Systems, P. G. Fonteolliet, Artech House, 1991.

## Course Name: Distributed Computing

**Credit Hours:** 3
**Prerequisites:** Introduction to Software Development

**Objectives:**

This course is intended to provide a sound background for net centric software development. The course will concentrate an overview of major technologies like CORBA, RMI, .NET and will highlight the interfacing of middle layer with the upper layers and system layer

**Course Outline:**

Introduction to distributed systems, Distributed data, Distributed processing system, Multithreading, Thread synchronization, Resource brokerage, Resource monitoring, Load balancing, Storage elements, Batch processing models, Middle layer architecture, Resource clustering, RMI, CORBA, Net, MPI.

**Suggested Text Books:**

- Distributed Systems: Principles and Paradigms by Tanen Baum. 2nd Edition
- Distributed Systems: Concepts and Design (International Computer Science Series) by Jean Dollimore, Tim Kindberg, and George Coulouris

## Course Name: Distributed Database System

**Credit Hours: 3**
**Prerequisites:** Intro to Database Systems
**Objectives:**

To clearly describe the difference of Centralized database and Distributed database and enable the students to design/model a distributed database.

**Course Outline:**

Introduction, Overview of relational DBMS and Normalization, Distributed DBMS architecture, Distributed database design and Data Distribution Strategies, Replication/Fragmentation, Distributed Transaction Management, Distributed Query Processing, Distributed Concurrency Control, Distributed Data Security, Distributed Database Recovery.

**Suggested Text books:**

- Principals of Distributed Database Systems by Ozsu Tamer.
- Database Systems by Thomas Connolly.

## Course Name: Service Oriented Architectures

**Credit Hours:** 3

**Prerequisites:** Web System and Technologies

**Objectives:**

The aim of the course is to introduce the student with the concepts and techniques of service oriented architectures.

**Course Outline:**

SOA Fundamentals, layers of services, introduction to web services, SOA value proposition, enterprise service bus, service oriented analysis and design, SOA service lifecycle, business modeling and use cases, XML schema basics, web services description language, service identification, simple object access protocol, service design and implementation, business process implementation, service component architecture, information management in SOA and challenges in SOA.

**Suggested Text Books:**

- Service-Oriented Computing: Semantics, Processes, Agents by Munindar P. Singh
- Enterprise SOA: Service-Oriented Architecture Best Practices by Dirk Krafzig
- SOA in Practice: The Art of Distributed System Design (Theory in Practice) by Nicolai M. Josuttis

## Course Name: RDBMS using Oracle

**Credit Hours:** 3

**Prerequisites:** Introduction to database systems

**Objectives:**
The objective of this course is to prepare students for utilizing Oracle as a tool for developing relational database projects.

**Course Outline:**
RDBMS introduction, basic SQL statements, restricting and sorting rows, SQL IDE and select statements, single row functions in SQL, displaying data from multiple tables, aggregating data using group functions, join and group functions, sub queries, data manipulation language, sub queries and DML, managing database tables and constraints, other database objects, views and index, hierarchal queries and set operators, basics of PL/SQL, control statements, cursors and exceptions, PL/SQL procedures, packages and triggers, oracle developer suite, oracle form block, triggers, lovs, multiple forms, menus, reports.

**Suggested Text Books:**
Oracle Resources

## Course Name: Advance Object Oriented Programming using Java

**Credit Hours:** 3
**Prerequisites:** Programming Fundamentals
**Objectives:**
Understand major concepts of object-oriented programming**.** Knowledge and skills in OO design and program development**.** Experience in Java programming and program development within an integrated development environment**.** Certain skills in Internet and windows programming and using graphical user interface.

**Course Outline:**
Introduction to the object oriented programming paradigm, introduction to Java. Basic elements, classes and objects,methods,arrays in java, interfaces, polymorphism and inheritance, exception handling, streams and files, Graphical user interface (GUI), implementation of dynamic data structures, Introduction to some advanced topics, object oriented design,interfaces,eception handling.

**Suggested Text Books:**

- Java: An Introduction to Problem Solving and Programming, $5^{th}$ ed. W. Savitch and F. Carrano, Prentice Hall, 2008
- Effective Java (2nd Edition) by Joshua Bloch

## Course Name: IT Project Management

**Credit Hours:** 3

**Prerequisites:** None

**Objectives:**

The course focuses on knowledge and theory within IT project management.

**Course Outline:**

Description of an IT Project, life cycle of an IT project, the importance of IT project management, organization strategy and projects, ranking proposals and selection projects, organization: Structure and Culture, responsibility Matrices, project Communication Plan, Estimating Project Times and Costs, Top-Down versus Bottom-Up Estimating, Methods for Estimating Project Times and Costs Project planning, Network techniques (AOA, AON),Critical Path Method (CPM).Risk and risk management, Resources and resource scheduling, Critical chain. Reduction of project duration, Crash conditions. The tasks and responsibilities of a project manager. Managing project teams. Outsourcing: Managing inter-organizational relations. Project audit. Project closure.

**Suggested Text Books:**

- Information Technology Project Management
- A Guide to the Project Management Body of Knowledge: (Pmbok Guide)

## Course Name: Total Quality Management

**Credit Hours:** 3

**Prerequisites: None**

**Objectives:**

TQM is a management concept. The basis of TQM is to reduce the errors produced during the manufacturing or service process, increase customer satisfaction, aim for modernization of equipment and ensure workers have the highest level of training. One of the principal aims of TQM is to limit errors to 1 per 1 million units produced. Total Quality Management is often associated with the development, deployment, and maintenance of organizational systems that are required for various business processes.

**Course Outlines:**

Introduction, Foundation of Quality, Measurement of Quality, Tools and methods for Analytic Studies, Administrative System for quality Management, Planning and Strategic Management for Customer Value, Organizing for Total Quality, Control and Systems Improvement, Performance Measurement frameworks, Quality Management Processes, Quality control for Export Units, Total Safety system for TQM, Total quality Management standards.

**Text books:**

- Poornima M. Charantimath: Total quality Management
- Bill Evants and Peter Reynolds:Total Quality

- Gitlow, Oppenheim and Levine, Quality Management

## Course Name: Entrepreneurship

**Credit Hours:** 3

**Prerequisites: None**

**Objectives:**

This is course provide students with an understanding of the entrepreneurship process. It exposes them to the concepts, practices and tools of the entrepreneurial world. This will be accomplished through a combination of readings, case studies and projects designed to convey the unique environment of the entrepreneurs and new ventures. The course gives students the tools necessary to think creatively, to plan out whether their idea is marketable to investors, guide them to launch their own business, or to support an employer in launching and growing an entrepreneurial venture. As IT students the focus shall be on items particularly important for technology ventures.

**Course Outline:**

The nature and importance of entrepreneurs, development of entrepreneurs, entrepreneurial decision process, role of entrepreneurs in economic development, ethics and social responsibility of entrepreneurs, the future of entrepreneurship, the entrepreneurial mind, the entrepreneurial process, managerial vs. entrepreneurial decision making, entrepreneurial leadership characteristics, international entrepreneurship opportunities, the nature of international entrepreneurship, importance of international entrepreneurship, entrepreneurial entry into international business, environmental analysis, developing the management team, building the successful organization, preparing for the new launch, managing early growth of the new venture, franchising.

**Text Books:**

- Dean A. Shepherd: Entrepreneurship
- Paul Burns and Jim Dew Hurst: Small Business and Entrepreneurship

## Course Name: Strategic Information Management

**Credit Hours:** 3

**Prerequisites:** None

**Objectives:**

This course covers IT and productivity, data issues, methods and data, potential data problems, Sensitivity analysis and rate of returns in IT and Managerial implications.

**Course Outline:**

The nature of strategic management**,** the business vision & mission the external assessment the internal assessment strategies in action strategy analysis & choice, implementing strategies: management & operations issues, strategy review, evaluation & control and SWOT analysis.

**Suggested Text Books:**

- David, F.R. (2009). Strategic Management Concepts and Cases, 12 Ed., Pearson International.

## Course Name: Human Resource Management

**Credit Hours:** 3

**Prerequisites:** None

**Objectives:**

Organizations succeed through efficient and effective use of resources; central to the resources is human resources. It is therefore imperative to know how organization maintain and retain its human resources. The course is designed to give students insight of theoretical prospective, concepts, issues and practices in human resource management.

**Course Outline:**

Introduction to HRM, Human Resource Planning, Job design and analysis, recruitment and selection, motivation and reward system, career planning and development, training and development, performance appraisal, compensation management and employee relation employee health and safety.

**Suggested Text Books:**

- Garry Dessler, Human Resource Management
- Dale S. Beach, Personel, The Management of people at work
- Holdin, Human Resource Management
- William B. Werther and Keith Davis Human Resource and Palnning, McGraw Hill.