# Road Map for Affiliated Colleges under Semester System

## BS (Computer Science) Session 2017-21

### Semester 1

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credit Hours</th>
</tr>
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<tbody>
<tr>
<td>CSI-303</td>
<td>Introduction to ICT</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>CSI-301</td>
<td>Programming Fundamentals</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>ENG-322</td>
<td>English Composition &amp; Comprehension</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>MTH-323</td>
<td>Calculus and Analytical Geometry</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>LNG-321</td>
<td>Chinese Language</td>
<td>3(3-0)</td>
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### Semester 2

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<tr>
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<th>Credit Hours</th>
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<tbody>
<tr>
<td>CSI-304</td>
<td>Digital Logic and Design</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>CSI-302</td>
<td>Object Oriented Programming</td>
<td>4(3-1)</td>
</tr>
<tr>
<td>ENG-421</td>
<td>Communication &amp; Presentation Skills</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>STA-324</td>
<td>Probability and Statistics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>PHY-323</td>
<td>Applied Physics</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>ECO-408</td>
<td>Issues in Pakistan Economy</td>
<td>3(3-0)</td>
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<tbody>
<tr>
<td>CSI-403</td>
<td>Computer Organization &amp; Assembly Language</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>CSI-401</td>
<td>Data Structure and Algorithms</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>CSI-405</td>
<td>Discrete Structures</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>CSI-411</td>
<td>Professional Practices</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>MTH-423</td>
<td>Differential Equations</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>MTH-424</td>
<td>Linear Algebra</td>
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<tbody>
<tr>
<td>CSI-406</td>
<td>Design &amp; Analysis of Algorithms</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>CSI-402</td>
<td>Operating Systems</td>
<td>4(3-1)</td>
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<tr>
<td>CSI-404</td>
<td>Theory of Automata</td>
<td>3(3-0)</td>
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<tr>
<td>CSI-408</td>
<td>Numerical Computing</td>
<td>3(3-0)</td>
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<tr>
<td>BBA-506</td>
<td>Human Resource Management</td>
<td>3(3-0)</td>
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<tbody>
<tr>
<td>CSI-505</td>
<td>Compiler Construction</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>CSI-503</td>
<td>Database Systems</td>
<td>4(3-1)</td>
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<tr>
<td>SWE-503</td>
<td>Software Engineering-I</td>
<td>3(3-0)</td>
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<tr>
<td>MTH-324</td>
<td>Multivariable Calculus</td>
<td>3(3-0)</td>
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<tr>
<td>SOC-555</td>
<td>Psychology</td>
<td>3(3-0)</td>
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### Semester 6

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<th>Course Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>CSI-508</td>
<td>Artificial Intelligence</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>CSI-512</td>
<td>Computer Networks</td>
<td>4(3-1)</td>
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<tr>
<td>CSI-506</td>
<td>Web Design and Development</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>CSI-504</td>
<td>Distributed Database Systems</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>ENG-510</td>
<td>Technical &amp; Business Writing</td>
<td>3(3-0)</td>
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### Semester 7

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<th>Course Title</th>
<th>Credit Hours</th>
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<tbody>
<tr>
<td>CSI-615</td>
<td>Mobile and Application Development</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>SWE-603</td>
<td>Software Engineering-II</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>CSI-621</td>
<td>Parallel &amp; Distributed Computing</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>CSI-619</td>
<td>Information Security</td>
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<tr>
<td>PST-321</td>
<td>Pakistan Studies</td>
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### Semester 8

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<th>Credit Hours</th>
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<tbody>
<tr>
<td>CSI-616</td>
<td>Fundamental of Data Mining</td>
<td>3(3-0)</td>
</tr>
<tr>
<td>CSI-604</td>
<td>Computer Graphics</td>
<td>3(2-1)</td>
</tr>
<tr>
<td>CSI-630</td>
<td>Final Year Project</td>
<td>6(0-6)</td>
</tr>
<tr>
<td>ISL-321</td>
<td>Islamic Studies/Ethics</td>
<td>3(3-0)</td>
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<td><strong>Total</strong></td>
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**Grand Total= 131**
Course Name: Programming Fundamentals

Course Structure: Lectures: 3, Labs: 1    Credit Hours: 4

Prerequisites: None

Objectives: The course is designed to familiarize students with the basic structured programming skills. It emphasizes upon problem analysis, algorithm designing, and program development and testing.

Course Outline: Overview of computers and programming. Overview of language for e.g. C language C. Basics of structured and Modular programming. Basic Algorithms and problem solving, development of basic algorithms, analyzing problem, designing solution, testing designed solution. Fundamental programming constructs, translation of algorithms to programs, data types, control structures, functions, arrays, records, files, testing programs.

Reference Material:

1. Problem Solving and Program Design in C / 6E
   Hanly & Koffman
   Addison-Wesley | Published: 02/06/2009

2. C How to Program, 5/E
Course Name: Introduction to ICT

Course Structure: Lectures: 3, Labs: 0, Credit Hours: 3

Prerequisites: None (first semester course)

Objectives:
This course focuses on a breadth-first coverage of the use of computing and communication technologies to solve real life problems; including computing environments, general application software like word processing, visual presentation applications, tabular data manipulation, DBMS, WWW, Email management systems, Virus, Anti-Virus and Spam Protection; Introduction to the basic computing hardware (main building blocks), operating systems, data networks; software engineering and communication technology along with social and ethical issues. An introduction of the program of study in computing for which this course is being taught (CS, IT, SE etc.). The course attempts to provide every student a set of productivity tools that they will be able to use for the rest of their lives.

Course Outline:
Number Systems, Binary numbers, Boolean logic, History computer system, basic machine organization, Von Neumann Architecture, Algorithm definition, design, and implementation, Programming paradigms and languages, Graphical programming, Overview of Software Engineering and Information Communication Technology, Operating system, Compiler, DBMS, Computer networks and internet, WWW, web mail applications, Computer graphics, AI, Viruses and Anti-Viruses, Use of office productivity tools, such as word processors, spreadsheets, presentation applications, etc., Social, Ethical, Professional and Legal Issues, and overview of the complete program of studies in computing and its structure.

Suggested Text Book:

Reference Material:
5. Computer Science: An overview of Computer Science, Sherer.
Course Name: English Comprehension and Composition

Course Structure: Lectures: 3, Labs: 0, Credit Hours: 3.

Objectives: Enhance language skills and develop critical thinking.

Course Contents:
Reading and Study skills, Note-taking on reading, Precis writing, Critical thinking skills, Dictionary Skills, Develop your own study reading system (detective novels), enhancing vocabulary,

For EAP & EFF if they are part of required degree
(Technical writing, Report writing (formal + informal report), writing of research proposal, writing of research paper, Interviews, Job interviews (face to face)and Telephonic Interviews)

- READING: Topic sentence, identify main idea, distinguish between Fact & Opinion, Skimming & Scanning, SQ3R, Notes taking techniques, Analyzing techniques in paragraph structure, identify writer’s intent (cause effect, reasons, comparison & contrast), making notes by using different techniques (tables, mind maps, lists, graphs etc), comprehension paragraph
- ACADEMIC WRITING: How to write a proposal for research paper/term paper. Difference between Summary & Review writing (Paragraphing optional). How to write a research paper/term paper (emphasis on style, content, language, form, clarity, consistency)
- REPORT WRITING: technical, progressive etc.

Note: Extensive reading is required for vocabulary building (Newspapers, story books, daily writing, learning, movies, magazines and Detective novels).

Recommended Books:

a) Essay Writing and Academic Writing

b) Presentation Skills

c) Reading
   1. The Mercury Reader. A Custom Publication. Compiled by norther Illinois University. General Editors: Janice Neulib; Kathleen Shine Cain; Stephen Ruffus and Maurice Scharton. (A reader which will give students exposure to the best of twentieth century literature, without taxing the taste of engineering students).
   2. Reading and Study Skills by John Langan
   3. Study Skills by Riachard Yorky
Course Name: Calculus and Analytic Geometry

Course Structure: Lectures: 3, Labs: 0  Credit Hours: 3

Prerequisites: None

Objectives: To provide foundation and basic ground for calculus and analytical geometry background.


Reference Material:
Course Name: Chinese language
Course Structure: lectures: 3  
Credit Hours: 3
Objectives: This course is designed for students who have little or no prior knowledge of Mandarin Chinese. The main focus of this course is to develop the Student’s oral communication skills in Mandarin. This course aims to help Students acquire basic tools to enable them to further in future, such as by mastering the Pinyin system, and by introducing them to basic Mandarin sentence patterns. Students will also learn how to read and Write several Chinese characters. By the end of the course, students should be able to engage in simple conversations in Mandarin.

Course Outline: Introduction to Mandarin Chinese ,Chinese Basic Language phonetic transcription (Pinyin), Strokes of Chinese characters, Common Greetings and Every day Expressions ,Making Introductions ,Numbers ,Talking about Your Family, Pointing Objects Out, Saying Where, how ,why and what ,Focus on Verbs ,Time Expressions, about weather, countries and nationalities ,Making Appointments ,name of body parts, Talking about Plans, part of speech ,likes and dislike sports ,fruits name color names ,seasons ,directions, eatery things, Hobbies, and Habits ,Shopping & Talking about Prices ,Sentence patterns, writing paragraph(related to daily conversation) buy things, buying ticket(train ticket, aero plane ticket ,cinema ticket) letter writing technique, Speak simple sentences Chinese Grammar & Simple conversations in different language situations , 50 characters(counting, date etc) ,the correct pronunciation and intonation Chinese language skills of listening, speaking, reading and writing and some of the culture.

Reference Material:
1. HSK Standard course 1, LEAD AUTHOR Jiang Liping other AUTHORS Wang Fang, Wang Feng, Liu liping.
2. Lets learn Chinese together,MS. Nuzhat Farooq.
3. HSK 1 vocabulary.
Semester-2

**Course Name:** Object Oriented Programming

**Course Structure:** Lectures: 3, Labs: 1   **Credit Hours:** 4

**Prerequisites:** Programming Fundamentals

**Objectives:** The course aims to focus on object-oriented concepts, analysis and software development.

**Course Outline:** Evolution of Object Oriented (OO) programming, OO concepts and principles, problem solving in OO paradigm, OO programme design process, classes, methods, objects and encapsulation; constructors and destructors, operator and function overloading, virtual functions, derived classes, inheritance and polymorphism. I/O and file processing, exception handling.

**Reference Material:**
1. C++ How to Program, 6/E  
   (Harvey & Paul) Deitel & Deitel ISBN-10: 0136152503  
2. Java How to Program, 7/E  
Course Name: Digital Logic and Design
Course Structure: Lectures: 3 / Labs: 0 Credit Hours: 3
Prerequisites: Discrete Structures, Introduction to Computing
Objectives: This course introduces the concept of digital logic, gates and the digital circuits. Further, it focuses on the design and analysis combinational and sequential circuits. It also serves to familiarize the student with the logic design of basic computer hardware components.

Course Outline:
Overview of Binary Numbers, Boolean Algebra, switching algebra, and logic gates, Karnaugh Map and Quin-McCluskey methods, simplification of Boolean functions, Combinational Design; two level NAND/NOR implementation, Tabular Minimization, Combinational Logic Design: adders, subtracters, code converters, parity checkers, multilevel NAND/NOR/XOR circuits, MSI Components, design and use of encoders, decoders, multiplexers, BCD adders, and comparators, Latches and flip-flops, Synchronous sequential circuit design and analysis, Registers, synchronous and asynchronous counters, and memories, Control Logic Design, Wired logic and characteristics of logic gate families, ROMs, PLDs, and PLAs, State Reduction and good State Variable Assignments, Algorithmic State Machine (ASM) Charts, Asynchronous circuits, Memory systems, Functional organization, Multiprocessor and alternative architectures: Introduction to SIMD, MIMD, VLIW, EPIC; systolic architecture; interconnection networks; shared memory systems; cache coherence; memory models and memory consistency, Performance enhancements, Contemporary architectures.

Reference Material:
Course Name: Communication and Presentation Skills  
Course Structure: lectures: 3, Labs: 0, credit hours: 3.  
Objectives: Enable the students to meet their real life communication needs.  
Course contents: The seven C’s of communication, Levels of communication, The process of communication, Types of communication (in detail), Flow of communication, Communication Networks in an organization, Formal Network, Informal Network, Principals of effective communication and barriers to communication, Basic Skills (Writing, Listening, Speaking, Reading,..).  
- LISTENING SKILLS: What is listening? Types of listening, Objectives & Barriers to listening, Note taking tips. Improved by AV aids used & recommended by the teacher.  
- ORAL/SPEAKING SKILLS:  
  o PRESENTATION SKILLS: Personality development (emphasis on content, style and pronunciation). Successful persuasive public speaking, Importance of oral communication, Effective Presentative strategies, organizing & preparing outline, visual aids.  
  o INTERVIEWS: Types of interviews, tips for successful interview.  
- READING SKILLS: Definition & Importance of reading, levels & requirements, how to improve reading skills & study skills as below.  
  o STUDY SKILLS: Skimming and Scanning, Intensive and extensive, Speed reading, Summary, main idea and critical summary.  

RECOMMENDED BOOKS:  
a) Grammar  
b) Writing  
c) Reading  
2. Reading and Study Skills by John Langan  
3. Study Skills by Riachard Yorky
Course Name: Probability and Statistics

Course Structure: Lectures: 3, Labs: 0    Credit Hours: 3

Prerequisites: None

Objectives: To introduce the concepts of data analysis, presentation, counting techniques, probability and decision making.

Course Outline: Introduction to Statistics, Descriptive Statistics, Statistics in decision making, Graphical representation of Data Stem-and Lead plot, Box-Cox plots, measures of central tendencies and dispersion, moments of frequency distribution; Counting techniques, introduction to probability, sample space, events, laws of probability, Conditional probability and Baye’s theorem with application to random variable (Discrete and continuous) Binomial, Poisson, Geometric, Negative Binomial Distributions; Exponential Gamma and Normal distributions. Regression and Correlation, Estimation and testing of hypotheses, use of elementary statistical packages for explanatory Data analysis.

Reference Material:
Course Name: Applied Physics

Course Structure: Lectures: 3, Labs: 0  Credit Hours: 3

Course Outline
Vector, Properties of vectors, Position, Velocity and acceleration vectors, Motion with constant acceleration, Motion in three dimensions with constant acceleration, Newton’s laws in three dimensional vectors form, Projectile motion, Drag forces and the motion of projectiles, Momentum, Linear and angular momentum, Impulse and momentum, Conservation of momentum, Two body collision, Center of mass, Two particles system, Many particles system, Rotational motion and variables, Rotation with constant angular acceleration, relation between linear and angular variables, energy, Kinetic and potential energy, Work, Energy and work done by a constant force, Fluid flow, Streamlines and equation of continuity, Oscillator, Simple harmonic oscillator, Simple harmonic motion, Energy and applications, Damped harmonic oscillation, Mechanical waves and Types, Wave speed on stretched string, Energy in wave motion, Interference of waves, Standing waves and resonance, Properties of sound waves, Traveling sound waves, Power and intensity of sound waves, Beats, Doppler effect,

1. To Study the damping features of an oscillation system using simple pendulum of variable mass.
2. To determine the value of ‘g’ be compound pendulum.
3. To determine the modulus of rigidity of a flat spiral spring.
4. To determine the modulus of rigidity of a wire by solid cylindrical rod.

Recommended Books:

3. Sears, Zemansky and Young, 2000, University Physics, 8th Ed, Addison-Wesley. Reading (MA) USA.
Course Name: **Issues in Pakistan Economy**

**Course Structure:** Lectures: 3, Labs: 0  Credit Hours: 3

**Course Contents**

**Overview of Pakistan Economy**


**Development Planning and Resource Mobilization**


**Agriculture and Industrial Development: Emerging Issues**


**Sectoral Development, Employment Pattern and Unemployment**


**International Debt and Dependency**


**Poverty and Income Distribution**


**Inflation, Foreign Trade Deficit and Emerging Issues**


**Recommended Books**

- Human Development In South Asia, Annual Report.
- World Development Reports, World Bank.
**Semester-3**

**Course Name:** Data Structures and Algorithms  
**Course Structure:** Lectures: 2 / Labs: 1  
**Credit Hours:** 3  
**Prerequisites:** Object Oriented Paradigms  

**Objectives:** The course is designed to teach students structures and schemes, which allow them to write programs to efficiently manipulate, store, and retrieve data. Students are exposed to the concepts of time and space complexity of computer programs.

**Course Outline:** Introduction to data structures; Arrays, Stacks, Queues, Priority Queues, Linked Lists, Trees, and Graphs. Recursion, sorting and searching algorithms, Hashing, Storage and retrieval properties and techniques for the various data structures. Algorithm Complexity, Polynomial and Intractable Algorithms, Classes of Efficient Algorithms, Divide and Conquer, Dynamic, Greedy

**Reference Material:**  
*Data Structures and Algorithms (SAMS teach yourself), Lafore, Sams Publishing, 1999.*  
*Data Structures in JAVA, Standish, Addison Wesley, 2000*
Course Name: Professional Practices

Course Structure: Lectures: 3 / Labs: 0  Credit Hours: 3

Prerequisites: None

Objectives: A Computing graduate as professional has some responsibilities with respect to the society. This course develops student understanding about historical, social, economic, ethical, and professional issues related to the discipline of Computing. It identifies key sources for information and opinion about professionalism and ethics. Students analyze, evaluate, and assess ethical and professional computing case studies.

Course Outline: Introduction, Computing Ethics, Philosophy of Ethics, Ethics and the Internet, Intellectual Copy Right, Accountability and Auditing, Social Application of Ethics.

Resources:
2. Professional Issues in Software Engineering, M.F. Bott et. al.
Course Name: **Computer Organization and Assembly Language**

**Course Structure:** Lectures: 3, Labs: 0     **Credit Hours:** 3

**Prerequisites:** Digital Logic Design

**Objectives:** The main objective of this course is to introduce the organization of computer systems and usage of assembly language for optimization and control. Emphasis should be given to expose the low-level logic employed for problem solving while using assembly language as a tool. At the end of the course the students should be capable of writing moderately complex assembly language subroutines and interfacing them to any high level language.

**Course Outline:** Microprocessor Bus Structure: Addressing, Data and Control, Memory Organization and Structure (Segmented and Linear Models), Introduction to Registers and Flags, Data Movement, Arithmetic and Logic, Programme Control, Subroutines, Stack and its operation, Peripheral Control Interrupts, Interfacing with high level languages, Real-time application. Objectives and Perspectives of Assembly Language, Addressing Modes, Introduction to the Assembler and Debugger, Manipulate and translate machine and assembly code, Describe actions inside the processing chip, Discuss operations performed by an instruction set, Write a fully documented program, Using an assembler of choice.

**Reference Material:**
Course Name: Discrete Structures

Course Structure: Lectures: 3 / Labs: 0  Credit Hours: 3

Prerequisites: None

Objectives: Introduces the foundations of discrete mathematics as they apply to Computer Science, focusing on providing a solid theoretical foundation for further work. Further, this course aims to develop understanding and appreciation of the finite nature inherent in most Computer Science problems and structures through study of combinatorial reasoning, abstract algebra, iterative procedures, predicate calculus, tree and graph structures. In this course more emphasis shall be given to statistical and probabilistic formulation with respect to computing aspects.

Course Outline: Introduction to logic and proofs: Direct proofs; proof by contradiction, Sets, Combinatorics, Sequences, Formal logic, Prepositional and predicate calculus, Methods of Proof, Mathematical Induction and Recursion, loop invariants, Relations and functions, Pigeonhole principle, Trees and Graphs, Elementary number theory, Optimization and matching. Fundamental structures: Functions; relations (more specifically recursions); pigeonhole principle; cardinality and countability, probabilistic methods.

Reference Material:
Course Name: **Differential Equations**

**Course Structure:** Lectures: 3 / Labs: 0  **Credit Hours:** 3

**Prerequisites:** Calculus and Analytical Geometry

**Objectives:** Develop fundamental skills of solving ordinary differential equations, and developing differential equations for real-world problems.


**Reference Material:**
Course Name: Linear Algebra

Course Structure: Lectures: 3, Labs: 0  Credit Hours: 3

Prerequisites: None

Objectives: To provide fundamentals of solution for system of linear equations, operations on system of equations, matrix properties, solutions and study of their properties.


Reference Material:
Course Name: Design & Analysis of Algorithms

Course Structure: Lectures: 3 / Labs: 0  Credit Hours: 3

Prerequisites: Discrete Structure, Data Structures and Algorithms

Objectives: Detailed study of the basic notions of the design of algorithms and the underlying data structures. Several measures of complexity are introduced. Emphasis on the structure, complexity, and efficiency of algorithms.

Course Outline: Introduction; Asymptotic notations; Recursion and recurrence relations; Divide-and-conquer approach; Sorting; Search trees; Heaps; Hashing; Greedy approach; Dynamic programming; Graph algorithms; Shortest paths; Network flow; Disjoint Sets; Polynomial and matrix calculations; String matching; NP complete problems; Approximation algorithms.

Reference Material:
2. Algorithms in C++; Robert Sedgewick
Course Name: Operating Systems

Course Structure: Lectures: 3, Labs: 1  Credit Hours: 4

Prerequisites: None

Objectives: To help students gain a general understanding of the principles and concepts governing the functions of operating systems and acquaint students with the layered approach that makes design, implementation and operation of the complex OS possible.


Lab assignments involving different single and multithreaded OS algorithms.

Reference Material:
Course Name: Theory of Automata

Course Structure: Lectures: 3 Labs: 0  Credit Hours: 3

Prerequisites: Discrete Structures

Objectives: The course aims to develop an appreciation of the theoretical foundations of computer science through study of mathematical & abstract models of computers and the theory of formal languages. Theory of formal languages and use of various abstract machines as 'recognizers' and parsing will be studied for identifying/validating the synthetic characteristics of programming languages. Some of the abstract machines shall also study as 'Transducers'.

Course Outline: Finite State Models: Language definitions preliminaries, Regular expressions/Regular languages, Finite automata (FAs), Transition graphs (TGs), NFAs, Kleene's theorem, Transducers (automata with output), Pumping lemma and non regular language Grammars and PDA: Context free grammars, Derivations, derivation trees and ambiguity, Simplifying CFLs, Normal form grammars and parsing, Decidability, Chomsky's hierarchy of grammars Turing Machines Theory: Turing machines, Post machine, Variations on TM, TM encoding, Universal Turing Machine, Context sensitive Grammars, Defining Computers by TMs.

Text Books/Reference Books:
Course Name: Numerical Computing

Course Structure: Lectures: 3 / Labs: 0    Credit Hours: 3

Prerequisites: Calculus and Analytical Geometry

Objectives: On completion of this unit, students will be able to demonstrate programming proficiency using structured programming techniques to implement numerical methods for solutions using computer-based programming techniques using Matlab for all methods. The course must serve the purpose of scientific software development for science and engineering problems.


Reference Material:

5. Numerical Analysis by Berden Fairs
6. Numerical Analysis by Gerald
Course Name: **Human Resource Management**

**Course Structure:** Lectures: 3 / Labs: 0  **Credit Hours:** 3

**Prerequisites:** None


**Reference Material:**

*Managing Human Resource* by Wayne F. Cascio
Semester-5

Course Name: **Compiler Construction**

Course Structure: Lectures: 3 / Labs: 0   Credit Hours: 3

Prerequisites: Theory of Automata and Formal Languages

Objectives: At the end of the course students should understand the overall structure of a compiler, and will know significant details of a number of important techniques commonly used. They will be aware of the way in which language features raise challenges for compiler builders.


Reference Material:
Course Name: Database Systems

Course Structure: Lectures: 3, Labs: 1   Credit Hours: 4

Prerequisites: Data Structures and Algorithms

Objectives: The course aims to introduce basic database concepts, different data models, data storage and retrieval techniques and database design techniques. The course primarily focuses on relational data model and DBMS concepts.

Course Outline: Basic database concepts; Entity Relationship modelling, Relational data model and algebra, Structured Query language; RDBMS; Database design, functional dependencies and normal forms; Transaction processing and optimization concepts; concurrency control and recovery techniques; Database security and authorization. Small Group Project implementing a database. Physical database design: Storage and file structure; indexed files; b-trees; files with dense index; files with variable length records; database efficiency and tuning.

Reference Material:
Course Name: Software Engineering-I

Course Structure: Lectures: 3, Labs: 0  Credit Hours: 3

Prerequisites: Object Oriented Paradigm/Programming

Objectives: To study various software development models and phases of software development life cycle. The concepts of project management, change control, process management, software development and testing are introduced through hands-on Team Projects.

Course Outline: Introduction to Computer-based System Engineering; Project Management; Software Specification; Requirements Engineering, System Modelling; Requirements Specifications; Software Prototyping; Software Design: Architectural Design, Object-Oriented Design, UML modelling, Function-Oriented Design, User Interface Design; Quality Assurance; Processes & Configuration Management; Introduction to advanced issues: Reusability, Patterns; Assignments and projects on various stages and deliverables of SDLC.

Reference Material:
1. Software Engineering 8E by Sommerville Addison Wesley, 2006
**Course Name:** Multivariable Calculus

**Course Structure:** Lectures: 3 / Labs: 0  
**Credit Hours:** 3

**Prerequisites:** Calculus and Analytical Geometry

**Objectives:** The goals are to develop the skills to have ground knowledge of multivariate calculus and appreciation for their further computer science courses.


**Reference Material:**
Course Name: Psychology

Course Structure: Lectures: 3 / Labs: 0  Credit Hours: 3

Prerequisites: None

Objectives

• To develop understanding of the breadth of different approaches to Psychology.
• To gain awareness of the principles and perspectives of Psychology through the study of psychological theories, concepts and research.
• To develop the ability to identify ethical concerns, and apply Psychology to cultural, social and contemporary issues.
• To understand how to critically appraise concepts, theories and empirical evidence.
• To be familiar with a range of research methods.

Course Overview:

Psychology is “the study of the mind and behaviour” and the aim of the course is to familiarize students with a wide range of theories and research investigating human behaviour. The course has been developed to be as interesting and challenging as possible. The objective is to explore how Psychology has contributed to an understanding of individual, social and cultural diversity.

In addition, a substantial portion of the course focuses on psychological testing and measuring learning outcomes.

Required Text:

Course Name: **Distributed Database Systems**

Course Structure: Lectures: 2/Labs: 1  
Credit Hours: 3

Prerequisites: Introduction to Database Systems

Objectives:
Students will learn the usage of different design strategies for distributed databases, and will study query processing techniques as well as transaction management and concurrency control concepts used in such systems.

Course Outline:
Introduction to Distributed Data Processing; Distributed DBMS Architecture; Distributed Database Design: Issues, Fragmentation and Allocation; Integrity Constraints, Distributed Query Processing; Query Decomposition and Data Localization; Query Optimization; Distributed Transaction Management and Concurrency Control; Distributed DBMS Reliability and Replication Techniques; Multidatabase Systems.

Reference Material:
3. M. Buretta, Data Replication, Wiley, 1997
Course Name: Artificial Intelligence

Course Structure: Lectures: 3 / Labs: 0  Credit Hours: 3

Prerequisites: Data Structures

Objectives: This course focuses on the set of computational tools and techniques, which mimic the human decision-making process and capability.


Reference Material:
Course Name: **Computer Networks**

**Course Structure:** Lectures: 3, Labs: 1  **Credit Hours:** 4

**Prerequisites:** None

**Objectives:** To introduce students to the concept of computer communication. Analogue & digital transmission. Network Layers, Network models (OSI, TCP/IP) and Protocol Standards. Emphasis is given on the understanding of modern network concepts.

**Course Outline:** Analogue and digital Transmission, Noise, Media, Encoding, Asynchronous and Synchronous transmission, Protocol design issues. Network system architectures (OSI, TCP/IP), Error Control, Flow Control, Data Link Protocols (HDLC, PPP). Local Area Networks and MAC Layer protocols (Ethernet, Token ring), Multiplexing, Switched and IP Networks, Inter-networking, Routing, Bridging, Transport layer protocols TCP/IP, UDP. Network security issues. Programming exercises, labs or projects involving implementation of protocols at different layers.

**Reference Material:**
1. Introduction to Computer Networks /4, A. S. Tanenbaum, Prentice Hall 2003
2. Computer Networks and Internets, 5/E, 2008
Course Name: Web Design and Development

Course Structure: Lectures: 2 Lab:1 Credit Hours: 3

Prerequisites: Fundamentals of Information Technology (required)

Objectives:
This course will extend the WWW Technologies and Web Based Applications architecture, development, deployment and management concepts studied in the course of Fundamentals of Information Technology. The instructor is expected to cover an in-depth treatment of the web technology and applications related topics including web standards, protocols, web applications architecture, web services, search engine architectures, content management, web2, and semantic web, to explore some of the technologies used for display, data access and processing, and to give the students practice in integrating these to produce a functional web-based system.

Course Outline:
In-depth study of World Wide Web architectures, protocols and standards (HTTP, HTML, xHTML, CGI, XML, WML, cHTML, etc.), Web Technologies and Tools (such as scripting tools) for web application development and deployment (web servers, application servers, etc.), Web Based Applications including search engines and content management, management of large scale web based information systems, Web Services, Web2, Semantic Web, and Web3, principles of web site design, practical exercise in web site development.

Suggested Text Books:

Reference Material:
4. Morrison, Mike and Joline Morrison, Database Driven Websites, 2/e, Cengage Learning, 2002
5. Web Wizard series for various technologies, Addison-Wesley
Course Name: Technical and Business Writing

Credit Hours: 3  Prerequisites: None

Course Outline:

Reference Materials:
Course Name: Software Engineering-II  
Course Structure: Lectures: 3 / Labs: 0 Credit Hours: 3  
Prerequisites: Data Structures, Software Engineering–I  
Objectives: The students will study techniques for software verification, validation and testing. They would also study reliability and performance issues in software design and development.

Course Outline: Software verification and validation: Techniques are introduced to evaluate software correctness, efficiency, performance and reliability, integration of these techniques into a verification and validation plan. Technical reviews, software testing, programme verification, prototyping, and requirement tracing. Attitude of industry toward reliability and performance.

Reference Material:  
Software Engineering, Ian Sommerville, Addison-Wesley 2001,
Course Title: Mobile and Application Development
Credit Hours: 3(2-1)
Prerequisites: Web Technologies
Course Outline:
Reference Materials:
Course Name: Parallel and Distributed Computing  
Credit Hours: 3(3-0)  
Prerequisites: Data Communications and Computer Networks  

Course Outlines:

Reference Materials:
2. W. Stevens, Advanced Programming in the Unix Environment, Addison Wesley, 1993
Course Name: Information Security
Credit Hours: 3(3-0)
Prerequisites: Data Communication and Computer Networks
Course Outline:
Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; Encryption, Hashing and Digital Signatures; audit; intrusion detection and response; database security, hostbased and network-based security issues operational security issues; physical security issues; personnel security; policy formation and enforcement; access controls; information flow; legal and social issues; identification and authentication in local and distributed systems; classification and trust modeling; risk assessment
Reference Materials:
Pakistan Studies
Credit Hour:
Introduction/Objectives:
- Develop vision of historical perspective, government, politics, contemporary Pakistan, ideological background of Pakistan.
- Study the process of governance, national development, issues arising in the modern age and posing challenges to Pakistan.

Course Outline:
1. Historical Perspective
   b. Factors leading to Muslim separatism
   c. People and Land
      i. Indus Civilization
      ii. Muslim advent
      iii. Location and geo-physical features.
2. Government and Politics in Pakistan
   Political and constitutional phases:
   a. 1947-58
   b. 1958-71
   c. 1971-77
   d. 1977-88
   e. 1988-99
   f. 1999 onward
3. Contemporary Pakistan
   a. Economic institutions and issues
   b. Society and social structure
   c. Ethnicity
   d. Foreign policy of Pakistan and challenges
   e. Futuristic outlook of Pakistan

Recommended Books:
Semester-8

Course Name: Fundamental of Data Mining  
Credit Hours: 3(3-0)  
Prerequisites: Database Systems  

Course Outline:  
Data-Mining Concepts, Preparing the Data, Data Reduction, Learning From Data, Statistical Methods, Decision Trees and Decision Rules, Artificial Neural Networks, Ensemble Learning, Cluster Analysis, Association Rules, Web Mining and Text Mining, Genetic Algorithms, Fuzzy Sets and Fuzzy Logic, Visualization Methods, Data Mining Tools: Weka, CBA and Yale, etc.

Reference Materials:  
Course Name: Computer Graphics
Course Structure: Lectures: 2 / Labs: 1    Credit Hours: 3

Prerequisites: Object Oriented Programming, Visual Programming

Objectives: Study of various algorithms in computer graphics and their implementation in any programming language.

Course Outline: Graphics hardware. Fundamental algorithms. Applications of graphics. Interactive graphics programming — graph plotting, windows and clipping, and segmentation. Programming raster display systems, Differential Line Algorithm, panning and zooming. Raster algorithms and software — Scan-Converting lines, characters and circles. Scaling, Rotation, Translation, Region filling and clipping. Two and three dimensional imaging geometry (Perspective projection and Orthogonal projection) and transformations. Curve and surface design, rendering, shading, colour and animation.

Reference Material:
Course Name: Islamic Studies/ Ethics

Objectives:
This course is aimed at:
1 To provide Basic information about Islamic Studies
2 To enhance understanding of the students regarding Islamic Civilization
3 To improve Students skill to perform prayers and other worships
4 To enhance the skill of the students for understanding of issues related to faith and religious life.

Course Outlines

Introduction to Quranic Studies
1) Basic Concepts of Quran
2) History of Quran
3) Uloom-ul-Quran

Study of Selected Text of Holly Quran
1) Verses of Surah Al-Baqra Related to Faith (Verse No-284-286)
2) Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-11)
3) Verses of Surah Al-Mumanoon Related to Characteristics of faithful (Verse No-1-11)
4) Verses of Surah Al-Furqan Related to Social Ethics (Verse No-63-77)
5) Verses of Surah Al-Inam Related to Ihkam(Verse No-152-154)

Study of Selected Text of Holly Quran
1) Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6,21,40,56,57,58.)
2) Verses of Surah Al-Hashar (18,19,20) Related to thinking, Day of Judgment
3) Verses of Surah Al-Saf Related to Tafakar,Tadabar (Verse No.1-14)

Seerat of Holy Prophet (S.A.W) I
1) Life of Muhammad Bin Abdullah ( Before Prophet Hood)
2) Life of Holy Prophet (S.A.W) in Makkah
3) Important Lessons Derived from the life of Holy Prophet in Makkah

Seerat of Holy Prophet (S.A.W) II
1) Life of Holy Prophet (S.A.W) in Madina
2) Important Events of Life Holy Prophet in Madina
3) Important Lessons Derived from the life of Holy Prophet in Madina

Introduction To Sunnah
1) Basic Concepts of Hadith
2) History of Hadith
3) Kinds of Hadith
4) Uloom –ul-Hadith
5) Sunnah & Hadith
6) Legal Position of Sunnah

Selected Study from Text of Hadith

Introduction To Islamic Law & Jurisprudence
1) Basic Concepts of Islamic Law & Jurisprudence
2) History & Importance of Islamic Law & Jurisprudence
3) Sources of Islamic Law & Jurisprudence
4) Nature of Differences in Islamic Law
5) Islam and Sectarianism

Islamic Culture & Civilization
1) Basic Concepts of Islamic Culture & Civilization
2) Historical Development of Islamic Culture & Civilization
3) Characteristics of Islamic Culture & Civilization
4) Islamic Culture & Civilization and Contemporary Issues
Islam & Science
1) Basic Concepts of Islam & Science
2) Contributions of Muslims in the Development of Science
3) Quranic & Science

Islamic Economic System
1) Basic Concepts of Islamic Economic System
2) Means of Distribution of wealth in Islamic Economics
3) Islamic Concept of Riba
4) Islamic Ways of Trade & Commerce

Political System of Islam
1) Basic Concepts of Islamic Political System
2) Islamic Concept of Sovereignty
3) Basic Institutions of Govt. in Islam

Islamic History
1) Period of Khlaft-E-Rashida
2) Period of Ummayyads
3) Period of Abbasids

Social System of Islam
1) Basic Concepts of Social System of Islam
2) Elements of Family
3) Ethical Values of Islam

Reference Books:
1) Hameed ullah Muhammad, “Emergence of Islam”, IRI, Islamabad
2) Hameed ullah Muhammad, “Muslim Conduct of State”
3) Hameed ullah Muhammad, ‘Introduction to Islam
4) Mulana Muhammad Yousaf Islahi,”
6) Ahmad Hasan, “Principles of Islamic Jurisprudence” Islamic Research Institute, International Islamic University, Islamabad (1993)
9) Dr. Muhammad Zia-ul-Haq, “Introduction to Al Sharia Al Islamia” Allama Iqbal Open University, Islamabad (2001)