

**University of Lakki Marwat  
Khyber Pakhtunkhwa, Pakistan**



**Program**

**Bachelor of Science in Computer Science (BSCS)**

**04 Years Program**

**(As Per Old Policy)**

***Department of Computer Science & IT***

**Semester-I (Credit Hours: 13+2 = 15)**

Course Code	Course Title	Credit Hours	Pre-Requisites
	Information and Communication Technologies	3(2,1)	
	Programming Fundamentals	4(3,1)	
	Basic Electronics	3	
	Calculus and Analytical Geometry	3	
	Islamic Studies	2	

**Semester-II (Credit Hours: 14+1 = 15)**

Course Code	Course Title	Credit Hours	Pre-Requisites
	Object Oriented Programming	4(3,1)	Programming Fundamentals
	Multi-variate Calculus	3	
	Discrete Structures	3	
	English Composition & Comprehension	3	
	Pakistan Studies	2	

**Semester-III (Credit Hours: 15+2 = 17)**

Course Code	Course Title	Credit Hours	Pre-Requisites
	Statistics and Probability	3	
	Communication & Presentation Skills	3	English Composition & Comprehension
	Data Structures and Algorithms	4(3,1)	Object Oriented Programming
	Digital Logic and Design	4(3,1)	Applied Physics
	Introduction to Marketing	3	

**Semester-IV (Credit Hours: 15+2 = 17)**

Course Code	Course Title	Credit Hours	Pre-Requisites
	Operating Systems	4(3,1)	Data Structure & Algorithms
	Theory of Automata	3	
	Design and Analysis of Algorithms	3	Data Structure & Algorithms
	Microprocessors and Assembly language	4(3,1)	
	Differential Equations	3	

**Semester-V (Credit Hours: 15+2 = 17)**

<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>	<b>Pre-Requisites</b>
	Human Computer Interaction	3	
	Linear Algebra	3	
	Database Systems	4(3,1)	Data Structure & Algorithms
	Software Engineering	3	
	Computer Networks	4(3,1)	

**Semester-VI (Credit Hours: 15+1 = 16)**

<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>	<b>Pre-Requisites</b>
	Introduction to Data Mining	3	
	Digital Image Processing	4 (3, 1)	
	Technical and Business Writing	3	
	Fundamental of Management	3	
	Compiler Construction	3	Theory of Automata

**Semester-VII (Credit Hours: 18+1 = 19)**

<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>	<b>Pre-Requisites</b>
	Introduction to Cyber Security	3	
	Computer Architecture and Organization	3	
	Artificial Intelligence	4 (3,1)	Discrete Structure
	Introduction to Data Science	3	
	Human Resource Management	3	
	Final Year Project – 1	0-3	

**Semester-VIII (Credit Hours: 15+1 = 16)**

<b>Course Code</b>	<b>Course Title</b>	<b>Credit Hours</b>	<b>Pre-Requisites</b>
	Java Programming	4 (3,1)	
	Software Project Management	3	
	Big Data Analytics	3	
	Information Security	3	
	Final Year Project – 2	0-3	Final Year Project – 1

## SEMESTER-I

### Information and Communication Technologies (2+1=3)

#### COURSE OBJECTIVES:

Students successfully completing this course should be able to:

- Develop a vocabulary of key terms related to the computer and to software programs.
- Identify the components of a personal computer system.
- Demonstrate mouse and keyboard functions.
- Demonstrate window and menu commands and how they are used.
- Demonstrate how to organize files and documents on a USB/hard drive.
- Send email messages and navigate and search through the internet.

#### SYLLABUS:

Week	Topics
1.	Data and Information, Information Processing Cycle
2.	Introduction to Computer, Components of a Computer, Advantages and Disadvantages of Using Computers.
3.	Categories of Computers, Computer Applications in Society.
4.	<b>Input Devices:</b> Types of Input, Input for Smart Phones, Game Controllers, Digital Cameras, Voice Input, Video Input, Scanners and Reading Devices, Biometric Input,
5.	<b>Output Devices:</b> Terminals. Display Devices, LCD Monitors and LCD Screens, Plasma Monitors, CRT Monitors,
6.	Printers, Nonimpact Printers, Impact Printers, Speakers, Headphones, Data Projectors. Interactive Whiteboards
7.	<b>Storage Devices:</b> Hard disks, Flash Memory Storage, Solid State Drives, Memory Cards, USB Flash Drives, Cloud Storage, Optical Discs, Blue-Ray Discs, Magnetic Tapes, Magnetic Stripe Cards and Smart Cards, Microfilm and Microfiche, Enterprise Storage.
8.	Programming Languages
9.	<b>Mid Term Exam</b>
10.	<b>CPU:</b> Processor, Control Unit, Arithmetic Logic Unit, Machine Cycle.
11.	<b>Memory:</b> Data Representation, Memory Sizes, Types of Memory, RAM, Cache, ROM, Flash Memory, Primary and Secondary Memory
12.	<b>Software:</b> System Software, Operating Systems, Utility Programs. Application Software, Business Software, Graphics and Multimedia Software, Software for Home, Personal, and Educational Use, Web Applications
13.	Data Communication
14.	<b>Internet</b> , World Wide Web,
15.	<b>Networks</b> , Internet and Searching Techniques, E-Learning, Freelancing
16.	Enterprise Computing, Computer Security Risks, Viruses
17.	Introduction to MS Word, MS Excel, MS PowerPoint
18.	<b>Terminal Examination</b>

## TEXT/REFERENCE BOOKS/WEBSITES LINKS:

### Text Books:

1. Shelly, G. B., & Vermaat, M. E. (2012). *Discovering computers fundamentals: your interactive guide to the digital world (Latest ed.)*. Cengage Learning.

### Reference Books:

1. Sawyer, S. C., & Williams, B. (2000). *Introduction to Using Information Technology (Latest ed.)*. McGraw-Hill Higher Education
2. Brookshear, G. G., & Brookshear, J. G. (2002). *Computer science: an overview (Latest ed.)*. Addison-Wesley Longman Publishing Co., Inc.

### Website Links:

1. [https://www.tutorialspoint.com/computer\\_fundamentals/index.htm](https://www.tutorialspoint.com/computer_fundamentals/index.htm)
2. <https://codescracker.com/computer-fundamental/>

## PROGRAMMING FUNDAMENTALS

**Credit hours: 4 (3,1)**

**Total Marks: 100**

### Course Contents:

Introduction to computer Programming and problem analysis, Translation of algorithms into programs, introduction to programming with C Elements of Language: Standard I/O Statements and functions, Data Types (Primary and Secondary Data Types), Operators, Expression, Selection Structure Repetition structure, Arrays, One and Two dimensional arrays, Functions, Parameter passing, return statement, Recursion, Storage classes, Pointers, array and pointers, functions and pointers, Structures, Declaration, initialization, array of structures, Files, reading and writing of data into Text files.

### Reference Material:

- *C Programming by Robert Lafore. C++ Programming by Robert Lafore.*

## BASIC ELECTRONICS

**Credit hours: 3**

**Total Marks: 100**

### Course Contents:

Fundamentals of Semiconductor physics: Band theory, semiconductors (intrinsic and extrinsic), pn junction, pn junctions as a rectifier, clipper and clamper circuits, zener diode and voltage regulator, LED and LCD etc., *Transistors*: Bipolar Junction transistors, BJT biasing circuits, Q-point, BJT as a switch, BJT amplifiers, classes of amplifiers, power amplifiers, Metal oxide transistors, nMOS, pMOS and CMOS inverters circuits. Introduction to A/D and D/A conversion circuits.

### Reference Material:

- *Freedman and Young, University Physics, (10<sup>th</sup> and higher editions). Resnick, Halliday and Krane, College Physics (6<sup>th</sup> and higher edition).*

## CALCULUS AND ANALYTICAL GEOMETRY

**Credit hours: 3**

**Total Marks: 100**

### **Course Contents:**

Real and Complex Numbers, Functions and Graphs, Sequences, Differentiation. Chain Rule, Implicit Differentiation and its Applications, Rolle's and Mean value theorems, Approximations. Newton's and Picard's Methods, Maxima/Minima. Graph sketching, L'Hospital's Rule, Integration as limit of sum and its applications.

### **Reference Material:**

- *Calculus and Analytic Geometry by SwoKowski, Olinick and Pence*

## ISLAMIC STUDIES

**Credit Hours: 2**

**Total Marks: 60**

### **Course Contents:**

Introduction to Quranic studies, Basic concepts and history of Quran, Uloom-ul-Quran, verses of surah Al-Baqra related to Faith (Verse no 284-286), verses of surah Al-Hujrat related to Adab al-Nabi (Verse no 1-18), verses of surah Al-Mumanoon related to characteristics of Faithful (Verse no 1-11)

**Seerat of Holy Prophet (S.A.W):** Life of Muhammad Bin Abdullah (Before Prophet hood), Life of Holy Prophet (S.A.W) in Makkah and Madina, Important lessons delivered from the life of Holy Prophet (S.A.W) in Makkah and Madina.

**Introduction to Sunnah:** Basic concepts of Hadith, History and kinds of Hadith, Uloom-ul-Hadith, Sunnah and Hadith, Legal position of sunnah

**Introduction to Islamic Law and Jurisprudence:** Introduction to Islamic Law and Jurisprudence, History and importance of Islamic law and Jurisprudence, sources of Islamic law and Jurisprudence, Nature of differences in Islamic law, Islam and Sectarianism.

**Islamic Culture and Civilization:** Basic concepts of Islamic Culture and Civilization, historical development of Islamic Culture and Civilization, characteristics, Islamic Culture and Civilization and contemporary issues.

**Islam and Science:** Basic concept of Islam and science, Contributions of Muslims in the development of science, Quranic and Science.

**Islamic Economics System:** Basic concepts of Islamic economic system, Means of distribution of wealth in Islamic economics, Islamic concept of riba, Islamic ways of trade and commerce

**Political System of Islam:** Basic concepts of Islamic Political system, Islamic concept of Sovereignty, Basic institutions of govt. in Islam

**Islamic History:** Period of Khilafat-e-Rashida, Umayyads and Period of Abbasids

**Social System of Islam:** Basic concepts of social system of Islam, elements of family, ethical values of Islam

### **Reference Material:**

- *Hameed Ullah Muhammad, "Emergence of Islam", IRI, Islamabad*
- *Hameed Ullah Muhammad, "Muslim Conducts of State", IRI, Islamabad*
- *Hameed Ullah Muhammad, "Introduction to Islam", IRI, Islamabad*

## **SEMESTER-II**

### **OBJECT ORIENTED PROGRAMMING**

**Credit hours: 4 (3,1)**

**Total Marks: 100**

**Course Contents:**

Object Oriented Technology: Design programming concepts, Objects and classes; procedure and loop, Data abstraction and classes, class constructors and destructors, Automatic Conversion and type casts for classes, conversion functions, Dynamic memory and classes, Class Inheritance, deriving a class, inheritance, virtual functions, Multiple inheritance with polymorphism, Defining and driving C++ classes overloading operator. Streams and Files. Function and class templates.

**Reference Material:**

- *C++: How to Programme, Deitel and Deitel, 4/e, Pearson.*
- *C++ Programming by Robert Lafore.*

### **MULTI-VARIATE CALCULUS**

**Credit Hours: 3**

**Total Marks: 100**

**Course Contents:**

Infinite series. Vectors. Functions of several variables. Limits and continuity. Directional and Partial derivatives. Vector Analysis: Vector Functions and derivatives. Line Integral. Multiple Integral: Double and Triple Integrals. Areas and Volumes.

**Reference Material:**

- *Thomas and Finney: Calculus and Analytical Geometry, Addison Wisky*
- *Schaum's Easy Outline: Differential and Integral Calculus by Ayres, Franks:Mendelson, Elliott*
- *The Differential and Integral Calculus by Augustus De Morgan Anton Howard: Calculus with Analytical Geometry, Wiley*

### **Discrete Structure**

**Credit hours: 3**

**Total Marks: 100**

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, Propositional 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: 1. Kenneth H. Rosen, Discrete Mathematics and Its Applications, 6TH edition, 2006, Mcgraw Hill Book Co.  
2. Richard Johnsonbaugh, Discrete Mathematics, 7 TH edition, 2008, Prentice Hall Publishers.  
3. Kolman, Busby & Ross, Discrete Mathematical Structures, 4th edition, 2000, Prentice-Hall Publishers.

## ENGLISH COMPOSITION AND COMPREHENSION

**Credit hours: 3**

**Total Marks: 100**

### **Course Contents:**

Grammar, Parts of Speech (Noun, Pronoun, Adjective verb, adverb, conjunction, interjection), Sentence Construction, Sentence: Kinds simple, compound complex, negative, interrogative clauses. Punctuation: Capitalization, signs of punctuation. Voice: Active, Passive. Narration: Direct, Indirect composition. Letter writing (social and business letters), Comprehension and précis writing.

### **Reference Material:**

- *Warriner's English Grammar and Composition*, John E. Warriner

## PAKISTAN STUDIES

**Credit Hours:2**

**Total Marks: 40**

### **Course Contents:**

#### **Historical Perspective**

Ideology rationale with special reference to Sir Syed Ahmad Khan, Allama Muhammad Iqbal and Quaid-e-Azam Muhammad Ali Jinnah

Factors leading to Muslim separatism, **People and Land**, Indus civilization, Muslim advent, Location and geo-physical features.

#### **Government and Politics in Pakistan**

Political and constitutional phases:

1947-58, 1958-71, 1971-77, 1877-88, 1988-99, 1999 onward

#### **Contemporary Pakistan**

Economics institutions and Issues, Society and social structure, Ethnicity, foreign policy and challenges, Futuristic outlook of Pakistan.

### **Reference Material:**

- *Burki, Shahid Javed, State and Society in Pakistan, the Macmillan press Ltd 1980.*
- *Akbar, S. Zaidi. Issues in Pakistan's Economy. Karachi: Oxford University Press,2000.*
- *Mehmood, safdar. Pakistan Political Roots and development. Lahore, 1994.*



## **SEMESTER-III**

### **STATISTICS AND PROBABILITY**

**Credit Hours: 3**

**Total Marks: 100**

**Course Contents:**

Measures of central tendency and dispersion. Moments and Kurtosis. Sampling and Probability. Random variables. Chebychev inequality. Binomial, Poisson and normal distributions. Correlation and Regression (simple), Shannon entropy, Dining cryptographic algorithm.

**Reference Material:**

- *Introduction to Statistics by Wallpole*
- *Elements of Statistics by Sher Muhamamd Chaudry*

### **COMMUNICATION & PRESENTATION SKILLS**

**Credit Hours:3**

**Total Marks: 100**

**Course Contents:**

Levels of communication: Interpersonal, Interpersonal, Mass Communication Internal communication: Top-down, bottom-up. Horizontal, vertical, verbal non-verbal.

Process of writing (Seven Cs), Observing, audience collecting, composing, drafting and revising. Listening skills. Mechanism of Business letter writing and memo. Various types of business letter and job applications. Proposal writing. Conducting meetings and small group communication and presentation skill. Developing an outline, facts and opinions.

**Reference Material:**

- *Business English, Vawdrey, Stoddard, Bell.*

### **DATA STRUCTURES AND ALGORITHMS**

**Credit Hours: 4(3,1)**

**Total Marks: 100**

**Course Contents:**

Introduction to data structures, Linear and Non Linear Data structures, Static and dynamic data structures, Abstraction and Abstract Data Types, Introduction to algorithm, Basic notation and basic algorithm, algorithms for various data structures, arrays their storage and retrieval techniques, stack, Queue, Operations on stack and queue, related algorithms, Linked lists, One way and two way Linked Lists and their related algorithms, trees, general and binary trees, tree terminologies, Tree construction and traversing techniques, Polish Notation, Heaps and Heap sort, Hashing.

**Reference Material:**

- *Data Structures and Algorithms by Mark Allen Weise.*
- *Data Abstraction and Problem solving with C++, Frank M. Carrano*

## **DIGITAL LOGIC AND DESIGN**

**Credit hours: 4 (3,1)**

**Total Marks: 100**

### **Course Contents:**

Number Systems, Boolean algebra, logic gates simplification. Algebraic manipulations, k-map method, combinational circuits. Half adders, full adders, decoders, encoders, multiplexers and demultiplexers. Applications of combinational circuits, sequential circuits. Flip flop, registers, counters.

### **Reference Material:**

- *Digital Logic and Design by M. Morris Mano.*

## **INTRODUCTION TO MARKETING**

**Credit Hours:3**

**Total Marks: 100**

### **Course Contents:**

Introduction & Marketing Modern World: Definition, Importance of marketing, Basic elements of Marketing, Implementation of Marketing's concepts, Market opportunity analysis, Marketing environment forces. The Marketing Environment: Understanding the importance of environmental scanning and analysis, Political forces, Social and ethical issues, Govt. rules and regulations, Pro-competitive legislation, Economic and competitive forces, Technological forces. Target Markets: What are markets, Market segmentation approach, Variables for segmenting organizational markets, Marketing Decisions, Information required for marketing decision, Reasons for obtaining information, Consumer Buying Behavior: Types of Consumer Decision Process, Influences on the consumer buying decision process, Understanding consumer Behavior. Product Life Cycle: Introduction, Growth, Maturity, Decline, Classification of product, Consumer Product, Business Product. Brand, Labeling & Packaging: Brand and types of brand, Criticism on packaging, Labeling, Types of labels. Distribution Decisions: Nature of marketing channels, Justification for intermediaries, Function of intermediaries, Function of facilitating agencies, Channel integration. Promotional Mix Promotion Decisions, the role of promotion, Promotion and communication process, the promotion mix, Cost and availability of promotional methods. Pricing: Pricing Decisions, the nature of Price, Price and non-price competition, Pricing objectives, Factors affecting pricing decisions, Pricing for Industrial markets

### **Reference Material:**

- Principle of Marketing by Phillip Kotler, 13<sup>th</sup> edition 2013
- Stanton Etzel 1998 Principle of marketing "M.G. Hill" 8<sup>th</sup> edition 2005

## **SEMESTER-IV**

### **OPERATING SYSTEMS**

**Credit Hours: 4 (3+1)**

**Total Marks: 100**

**Course Contents:**

Introduction to operating systems, purpose and function of operating system. Batch, time sharing, real time operating system, Process and threads management, Concurrent process, synchronization and mutual exclusion, resource allocation and deadlock detection and prevention, Scheduling, memory management, Real storage organization management and strategies, Virtual storage organization (Segmentation and paging).

**Reference Material:**

- *Operating Systems; Internals and Design Principles by William Stallings.*
- *Applied Operating Systems Concepts, 6<sup>th</sup> Edition, Silberschatz A., Peterson, J.L., & Galvin P.C. 1998.*
- *Modern Operating Systems, 2<sup>nd</sup> Edition, Tanenmaum A.S., 2001*

### **DESIGN AND ANALYSIS OF ALGORITHMS**

**Credit hours:3**

**Total Marks: 100**

**Course Contents:**

Introduction to algorithms, time and space trade off, Efficiency of algorithms, Rate of growth, Asymptotic notation, Complexity of algorithms, O,Ω, θ notations, sorting and searching algorithms and their complexities, fundamental algorithmic strategies: divide and Conquer, Greedy Approaches, Dynamic programming, Graph algorithms, Graph representation and traversing, Spanning trees, Minimum spanning trees, Shortest paths.

**Reference Material:**

- *Introduction to Algorithms by Thomas H. Coreman*

### **MICROPROCESSORS AND ASSEMBLY LANGUAGE**

**Credit Hours: 4 (3,1)**

**Total Marks: 100**

**Course Contents:**

Intel based Microprocessor (8086) Architecture: Bus Structure, Addressing, Data and Control, Memory Organization and Structure (Static RAM, Dynamic RAM), Introduction to Registers and Flags, Data Movement, Arithmetic and Logic, Programme Control, Subroutines. Objectives and Perspectives of Assembly Language, Addressing Modes, Introduction to the Assembler and Debugger, Manipulate and translate assembly code, Minimum mode, maximum mode, Interrupts, DMA

**Reference Material:**

- Cognitive and Social Models for Interaction Design
- *Irvine, Assembly Language for Intel-based Computers, 5th ed, Prentice Hall, 2007.*
- *Computer Organization and Design, The Hardware/Software Interface, 4th ed, by David A. Patterson and John L. Hennessy, 2008. Elsevier Publishers.*
- *Microprocessor by Douglas V.Hall*

**THEORY OF AUTOMATA****Credit Hours: 3****Total Marks: 100****Course Contents:**

Language definitions preliminaries, Regular expressions, Regular languages, Finite automata (FAs), NFAs, DFA's, Conversion of NFA to DFA using  $\epsilon$ -closure and Sub set methods, non-regular language Grammars: Context free grammars, Derivations, derivation trees and ambiguity, Associativity, left recursion, Left factoring, first and follow sets, Parsing, top down and bottom up parsing, Recursive decent parsing, non-recursive descent parsing, shift reduce parsing, construction of predictive parse table, push down automata and Turing machines.

**Reference Material:**

- *Introduction to Computer Theory, Denial Cohen, John Wiley & Sons, Inc.*
- *K.L.P Mishra, Theory of Computation.*

**DIFFERENTIAL EQUATIONS****Credit Hours: 3****Total Marks: 100****Course Contents:**

Ordinary Differential Equations of the First Order: Geometrical Considerations, Isoclines, Separable Equations, Equations Reducible to Separable Form, Exact Differential Equations, Integrating Factors, Linear First-Order Differential Equations, variation of Parameters. Ordinary Linear Differential Equations; Homogeneous Linear Equations of the Second Order, Homogeneous Second-Order Equations with Constant Coefficients, General Solution, Real Roots, Complex Roots, Double Root of the Characteristic Equation, Differential Operators, Cauchy Equation, Homogeneous Linear Equations of Arbitrary Order, Homogeneous Linear Equations of Arbitrary Order with Constant Coefficients, Non-homogeneous Linear Equations, Modelling of Electrical Circuits. Systems of Differential Equations. Series Solutions of Differential Equations, Partial Differential Equations: Method of Separation of variables, wave, Heat & Laplace equations and their solutions by Fourier series method.

**Reference Materials:**

- *Advanced Engineering Mathematics Michael, G.1996, Prentice Hall Publishers.*

- *Advanced Engineering Mathematics, 7th edition, Erwin, K. 1993, John Wiley Sons Inc. A First Course in Differential Equation Zill. Prindle. Weber. Schmidt.1996., Brooks/Cole Publishing*

## **SEMESTER-V**

### **Human Computer Interaction**

**Credit Hours: 3**

**Total Marks: 100**

#### **Course Contents:**

- HCI Definition. Human, Computer, Interaction. Usability, Requirement Analysis. Perception, Perceptual Process. Interaction. Interactivity, Types of Interaction, Models of Interaction. Contexts for HCI. Psychology of Usable things.  
Usability Heuristics and Principles of Usability testing
- Principles of good Interaction Design. Accessibility, Principles of GUI. Visual Design Elements.
- Data Gathering and Task Analysis, Prototyping. Help and User Documentation. Internationalization, Usability inspection Model. Usability Testing Methods. New Interaction Technology.  
Usability in Practice. Visual Design and Typography. Icon Design, Ubiquitous

#### **Reference Material:**

About Face: The Essentials of Interaction Design, Alan Cooper, Robert Reimann, David Cronin, Christopher Noessel, 4<sup>th</sup> Ed, Wiley, 2014

## **LINEAR ALGEBRA**

**Credit hours:3**

**Total Marks: 100**

#### **Course Contents:**

Vectors, Vector Spaces, Matrices & Determinants, Cofactor and Inverse, Rank, Linear Independence, Solution of system of Linear systems, Positive Definite matrix, Linear Transformations, Operations on matrices, Inner products, orthogonality and least squares, Eigenvalue & Eigenvectors. Applications to Systems of Equations and to Geometry, Singular Value Decomposition.

#### **Reference Material:**

- *Bernard Kolman, David Hill, Elementary Linear Algebra with Applications, 9<sup>th</sup> edition, Prentice Hall PTR, 2007.*
- *Gilbert Strang, Strang, Brett Coonley, Andy Bulman-Fleming, Andrew Bulman-Fleming, Strang's Linear Algebra and Its Applications, 4<sup>th</sup> edition, Brooks/Cole, 2005*
- *Howard Anton, Chris Rorres, Elementary Linear Algebra: Applications Version, 9<sup>th</sup> edition, Wiley, 2005.*
- *David C. Lay, Linear Algebra and Its Applications, 2<sup>nd</sup> edition, Addison-Wesley, 2000.*

## DATABASE SYSTEMS

**Credit hours: 4 (3,1)**

**Total Marks: 100**

### **Course Contents:**

Basic database concepts, Database approach vs file based system, database architecture, three level schema architecture, data independence, relational data model, attributes, schemas, tuples, domains, relation instances, keys of relations, integrity constraints, relational algebra, selection, projection, Cartesian product, types of joins, normalization, functional dependencies, normal forms, entity relationship model, entity sets, attributes, relationship, entity-relationship diagrams, Structured Query Language (SQL), Joins and sub-queries in SQL, Grouping and aggregation in SQL, concurrency control, database backup and recovery, indexes, NoSQL systems.

### **Reference Material:**

- *Database Systems: The Complete Book, 2<sup>nd</sup> Edition* by Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom
- *Database System Concepts, 6<sup>th</sup> Edition* by Avi Silberschatz, Henry F. Korth and S. Sudarshan.
- *Database Management Systems, 3<sup>rd</sup> Edition* by Raghu Ramakrishnan, Johannes Gehrke.
- *Database Systems: A Practical Approach to Design, Implementation and Management*, R.Connolly and P.Begg, Addison- Wesley Pub. Co (2003).

## SOFTWARE ENGINEERING

**Credit hours: 3**

**Total Marks: 100**

### **Course Contents:**

Introduction to software engineering, phases in software development, software development process models. Software requirement specification, planning and scheduling, software requirement specification, COCOMO model, project scheduling, system design, configuration management. System analysis and design concepts and principles, coding and testing fundamentals.

### **Reference Material:**

- *Software Engineering*, Pankaj Jalot
- *Software Engineering: A Practioner's Approach*, Roger Pressman, McGraw-Hill, 2001.

## COMPUTER NETWORKS

**Credit Hours: 4 (3,1)**

**Total Marks: 100**

### **Course Contents:**

Introduction to computer networks, network requirements and layered architectures. ISO reference model. Data encoding/framing, Ethernet and FDDI. Network layers and WANs. IP and Routing, cell switching and ATM, bridges, Internetworking-the global internet. End to End protocols, UDP, TCP, and RPC. Application layer, Routing and routed protocol: RIP, OSPF, IGRP and EIGRP, DHCP, the domain name system(DNS), and the WWW protocols.

### **Reference Material:**

- *Computer Networks; 3<sup>rd</sup> Edition* By Andrew S.Tanenbaum
- *Computer networks: a systems approach*, Larry Peterson, Bruce Davie, Princeton Univ., Princeton.
- *Computer Networking: A Top-Down Approach Featuring the Internet*, 2/e, James F Kurose, Keith W Ross, Addison Wesley 2003. ISBN: 0-201-97699-4



## **SEMESTER-VI**

### **INTRODUCTION TO DATA MINING**

**Credit Hours: 3**

**Total Marks: 100**

**Course Contents:**

Concepts of Data mining, data pre-processing (noisy and missing data, data normalization and discretization), outlier detection, Data mining learning methods, association rule mining, clustering, classification, fundamental of other algorithms to data mining, decision trees, rules, patterns and trends. Introduction to data mining tools.

**Reference Materials:**

- *Data Mining: Concepts and Techniques, 3rd Edition Jiawei Han, Micheline Kamber, Jian Pei; 2011*
- *Data Mining: Concepts, Models, Methods, and Algorithms, 2nd Edition, Mehmed Kantatardzic, 2011.*

### **INTRODUCTION TO DATA MINING**

**Credit Hours: 3**

**Total Marks: 100**

**Course Contents:**

**Prerequisites:** None

Concepts of Data mining, data pre-processing (noisy and missing data, data normalization and discretization), outlier detection, Data mining learning methods, association rule mining, clustering, classification, fundamental of other algorithms to data mining, decision trees, rules, patterns and trends. Introduction to data mining tools.

**Reference Material:**

1. *Data Mining: Concepts and Techniques, 3rd Edition Jiawei Han, Micheline Kamber, Jian Pei; 2011*
2. *Data Mining: Concepts, Models, Methods, and Algorithms, 2nd Edition, Mehmed Kantatardzic, 2011*

### **TECHNICAL AND BUSINESS WRITING**

**Credit Hours: 3**

**Total Marks: 100**

**Course Contents:**

Writing technical reports, research reports, research papers, and memos. Drafting, revising and editing compositions derived from science and technology to develop skills in narration, persuasion, analysis and documentation.

**Reference Material:**

- *Greenfield, T., Research Methods, Guidance for Postgraduates, Arnold, 1996,*

## FUNDAMENTALS OF MANAGEMENT

**Credit Hours:3**

**Total Marks: 100**

### **Course Contents:**

Introduction Definition- Importance (Role of Management) - Management as a Science or as an Art – Historical Evaluation – Principles of Management – Characteristics of Management, School of Management: Management by Custom School – Scientific Management School – Human Behavior School of management – The Social System School – Management Process School.

Planning: Nature and purpose of planning – Vital aspect of planning – steps in planning – Major types of management plans – M.B.O. Management by objectives – Merits and demerits of planning, organizing: Nature and purpose of organizing – Line and Staff Authority and its relationship- Basic Departmentation, Staffing: Nature and Importance of Staffing – Recruitment and Selection of manager, Controlling: Introduction – Types of controlling – Social Controlling Techniques.

### **Recommended Books:**

- *Terry/Franklin, Principles of Management 8<sup>th</sup> Edition*
- *R Satya Raju and A Parthasarthy (2003) Management Text and Cases.*

## COMPILER CONSTRUCTION

**Credit hours: 3**

**Total Marks: 100**

### **Course Contents:**

Introduction to programming language ideas and terminology introduction to compiling, lexical analysis, symbol tables, parsing, syntax directed translation, type checking, run-time organization, intermediate code generation, code generation, code optimization.

### **Reference Material:**

- *Compiler Design and Construction, by Alfred V. Aho, Ravi Sethi, Hardcover 2nd edition,1987, Van Nostrand Reinhold; ISBN: 0317636367*

## **SEMESTER-VII**

### **CYBER SECURITY**

**Credit hours: 3**

**Total Marks: 100**

**Course Contents:**

Basic security concepts, Information security terminology, Malware classifications, Types of malware. Server side web applications attacks. Cross-site scripting, SQL Injection, Cross-site request forgery, Planning and policy, Network protocols and service models. Transport layer security, Network layer security, Wireless security, Cloud & IoT security.

**Reference Material:**

- Security+ Guide to Network Security Fundamentals by Mark Ciampa, third Edition
- Corporate Computer Society by Randall J. Boyle, 3rd Edition

### **COMPUTER ARCHITECTURE & ORGANIZATION**

**Credit Hours: 3**

**Total Marks: 100**

**Course Contents:**

Fundamentals of Computer Design including performance measurements & quantitative principles. Principles of Instruction Set Design, Operands, addressing modes. RISC and CISC architectures. Pipelining Overview. Memory Hierarchy Design, Cache Design, Main Memory, Storage Systems, Parallelism.

**Reference Materials:**

- *Computer Organization and Architecture; Designing for Performance*  
7<sup>th</sup> Edition by Willaim Stallings
- *John L. Hennessy and David A. Patterson, Computer Architecture: A Quantitative Approach, 3rd Edition, Morgan Kaufmann Publishers, 2002.*

### **ARTIFICIAL INTELLIGENCE**

**Credit hours: 4(3,1)**

**Total Marks: 100**

**Course Contents:**

Human Intelligence and Artificial Intelligence. Tuning test, branches of A.I. Robotics: components, laws, types, (Intelligent vs. Non Intelligent) and applications. Natural language processing: natural and computer languages, natural language understanding, syntax, semantics, methodology, pragmatics, discourse analysis, cohesion and coherence, resolution of anaphora and anaphora, ambiguity, ellipses, communication, monolingual dictionary design, prepositional logic, predicate logic .Natural language generation, expert systems, characteristics of expert systems, uses and usefulness of expert systems, structure of expert systems, Speech recognition and

generation: How speech recognition systems work, speaker dependent and speaker independent system, Types of speeches: IWR, CWR, CSR, Applications of speech recognition. Introduction to computer vision and Neural Network.

**Reference Material:**

- *Expert Systems and its Applications Understanding Artificial Intelligence*

**Network Security**

**Credit hours: 3**

**Total Marks: 100**

Introduction; Cryptology and simple cryptosystems; Conventional encryption techniques; Stream and block ciphers; DES; More on Block Ciphers; The Advanced Encryption Standard. Confidentiality & Message authentication: Hash functions; Number theory and algorithm complexity; Public key Encryption. RSA and Discrete Logarithms; Elliptic curves; Digital signatures. Key management schemes; Identification schemes; Dial-up security. E-mail security, PGP, S-MIME; Kerberos and directory authentication. Emerging Internet security standards; SET; SSL and IPsec; VPNs; Firewalls; Viruses; Miscellaneous topics.

**Text Books/Reference Books:** 1. W. Stallings, Cryptography and Network Security, Prentice Hall PTR, Upper Saddle River, NJ, 2003.

2. Kaufman, R. Perlman, M. Speciner, Network Security: Private Communication in a Public World – Prentice Hall PTR, Upper Saddle River, NJ, 2002.

3. M. Bishop, Computer Security: Art and Science – Addison-Wesley, 2003.

4. Stinson, Cryptography: Theory and Practice, CRC Press, Boca Raton, FL, 1995.

5. Richard A. Mollin, An Introduction to Cryptography, Chapman and Hall/CRC, 2001.

**HUMAN RESOURCE MANAGEMENT**

**Credit hours: 3**

**Total Marks: 100**

**Course Content:**

Introduction HRM, Purpose of HRM, Objectives of HRM, Essentials of Management, HRM Activities, HRM areas, Case studies, Motivation process, Model motivation, Demand for Human Resources, Causes of Demand, Forecasting Techniques, Human Resource Requirements, Job design, Estimates of Internal Supply, HR Audits, Succession Planning, Replacement Charts and Summaries, External Needs, Labor Market Analysis, Job analysis and methods, Purpose of job analysis, Recruitment Constraints of Challenges, Internal Recruitment of Channels, SELECTION: Procedure, Selection Procedure / Steps, Preliminary Reception, Employment Tests, Selection Interviews, References and Backgrounds, Socialization process, Orientation, Training approaches, Organizational development, OD methods, Evaluating, training and development effectiveness, Elements of performance appraisal System, Performance appraisal challenges, Past and future oriented performance appraisal methods, Appraisal errors, Wages and Salaries, Incentives, Benefits and Services

**Reference Material:**

- Human Resource Management by R. Decenzo

- Management of People and Work by Dales & Beach

**CCC-10: PROJECT**

**Credit hours:**

**Note: Marks of software Project/Thesis will be awarded after the Evaluation of Project/Thesis in 8<sup>th</sup> Semester.**

**SEMESTER-VIII**

**COMPUTER GRAPHICS**

**Total Marks: 100**

**Course Contents:**

Fundamental Concepts: forward and backward rendering (i.e., ray-casting and rasterization), applications of computer graphics: including game engines, cad, visualization, virtual reality, polygonal representation, basic radiometry, similar triangles, and projection model, use of standard graphics APIs (see HCI GUI construction); basic rendering: rendering in nature, i.e., the emission and scattering of light and its relation to numerical integration, affine and coordinate system transformations, ray tracing, visibility and occlusion, including solutions to this problem such as depth buffering, painter's algorithm, and ray tracing, the forward and backward rendering equation, simple triangle rasterization, rendering with a shader-based API, texture mapping, including minification and magnification (e.g., trilinear MIP-mapping), application of spatial data structures to rendering, sampling and anti-aliasing, scene graphs and the graphics pipeline; geometric modeling: basic geometric operations such as intersection calculation, proximity tests, polynomial curves and surfaces, approximation techniques such as polynomial curves, bezier curves, spline curves and surfaces, animation as a sequence of still images.

**Reference Materials:**

- Computer Graphics with Open GL (4th Edition) by Donald D. Hearn, Prentice Hall, 2010, ISBN-10: 0136053580.
- Foundations of 3D Computer Graphics by S. J. Gortler, The MIT press, 2012.
- Fundamentals of Computer Graphics, 3rd Edition, A K Peters, 2009.
- Computer Graphics: Principles and Practice, 3rd Edition, Addison Wesley, 2013.
- Real-Time Rendering, 3rd Edition, A K Peters, 2008.

## **INFORMATION SECURITY**

**Credit Hours:3**

**Total Marks: 100**

### **Course Content**

Basic notions of confidentiality, integrity, availability; authentication models; protection models; security kernels; Encryption, Hashing and Digital, Signatures; audit; intrusion detection and response; database security, host based 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. Socket programming and introduction to privacy.

### **Reference Materials:**

- *Computer Security: Art and Science, Matthew Bishop Internet sources*
- *Cryptography and Network Security by William Stallings 6th Edition, 2012 Principles of Information Security 3rd E by Michael E. Whitman and Herbert J. Mattord*

## **PROJECT**

**Credit Hours: 6**

**Total Marks: 200**

The project will be started in semester 7<sup>th</sup> but marks will be awarded in Semester 8