University of Lakki Marwat
Khyber Pakhtunkhwa, Pakistan

Program

Master in Computer Science (MCS)
2 Years Program

(For Sessions 2020 and Onwards)

Department of Computer Science& IT

Semester-I (Credit Hours = 17 (15+2))

Course Code	Course Title	Credit Hours	Pre-Requisite
	Design & Analysis of Algorithm	3	Data Structure & Algorithms
	Database Systems	4(3,1)	Data Structure & Algorithms
	Linear Algebra * Similar course	3	
	Operating System	4(3,1)	Data Structure & Algorithms
	Introduction to Social Media Marketing ` * Similar course	3	

Semester-II (Credit Hours = 20 (18+2))

Course Code	Course Title	Credit Hours	Pre-Requisite
	Compiler Construction	3	Theory of Automata
	Software Engineering * Similar course	3	
	Web Technologies * Similar course	3	
	Digital Image Processing * Similar course	4(3, 1)	
	Computer Networks	4(3, 1)	
	Technical & Business Writing	3	

Semester-III (Credit Hours = 18)

Course Code	Course Title	Credit Hours	Pre-Requisite
	Introduction to Data Mining * Similar course	3	
	Theory of Programming Languages * Similar course	3	
	Final Year Project - I	0-3	
	Network Security * Similar course	3	
	Big Data Analytics * Similar course	3	
	E-Commerce * Similar course	3	

Semester-IV (Credit Hours = 17)

Course Code	Course Title	Credit Hours	Pre-Requisite
	Artificial Intelligence	4(3, 1)	Discrete Structures
	Human Computer Interaction * Similar course	4(3, 1)	
	Professional Practices * Similar course	3	
	Final Year Project – 2	0-3	Final Year Project - I
	Information Security * Similar course	3	

SEMESTER-I

DESIGN AND ANALYSIS OF ALGORITHMS

Credit hours: 3   **Total Marks: 100**

Course Contents:
Introduction; role of algorithms in computing, Analysis on nature of input and size of input Asymptotic notations; Big-O, Big Ω, Big Θ, little-o, little-ω, Sorting Algorithm analysis, loop invariants, Recursion and recurrence relations; Algorithm Design Techniques, Brute Force Approach, Divide-and-conquer approach; Merge, Quick Sort, Greedy approach; Dynamic programming; Elements of Dynamic Programming, Search trees; Heaps; Hashing; Graph algorithms, shortest paths, sparse graphs, String matching; Introduction to complexity classes;

Reference Material:
1.   *Introduction to Algorithms by Thomas H. Coreman*
2.   Algorithm Design, (1st edition, 2013/2014), Jon Kleinberg, Eva Tardos,

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, 2nd Edition by Hector Garcia-Molina, Jeffrey D. Ullman, Jennifer Widom*
- *Database System Concepts, 6th Edition by AviSilberschatz, Henry F. Korth and S. Sudarshan.*
- *Database Management Systems, 3rd Edition by RagGERamakrishnan, Johannes Gehrke.*
- *Database Systems: A Practical Approach to Design, Implementation and Management,R.Connolly and P.Begg, Addison- Wesley Pub. Co (2003).*

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

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

INTRODUCTION TO SOCIAL MEDIA MARKETING

Credit hours: 3   **Total Marks: 100**

Course Contents:
Introduction to social media and how it has altered the consumer decision-making process and communications paradigm. Describe the role of social media in marketing strategy and assess the tradeoffs in using social media relative to traditional communication methods. Learn how to set social media marketing objectives that are linked to business objectives. Overview of most popular Social Media Marketing Networks (Facebook, LinkedIn, Twitter, Instagram, YouTube). Understand the role of networks in the distribution of content, including network structure and how it affects the flow of information. Learn how to leverage online networks and communities to engage consumers in brand-related conversations. Discuss how to identify influencers and their role in distributing content. Learn how to create social media content that attracts and retains consumers' attention and motivates engagement and sharing. Describe the role of storytelling in a digital landscape. Understand how to evaluate and select platforms for distributing content. Use of Content Development Tools like Photoshop, Video Edit and WordPress. Describe organizational approaches to managing social media and developing social media policy. Discuss how to manage specific issues in social media, including negative feedback, online reviews, and crisis management. Identify ethical conflicts and issues associate with social media marketing decisions.

Reference Material:
1. .Introduction to Social Media Marketing: A Guide for Absolute Beginners 1st ed. Edition BY Todd Kelsey

SEMESTER-VI

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*

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

WEB TECHNOLOGIES

Credit hours: 3   **Total Marks: 100**

Course Contents:
Introduction to Web Applications, TCP/IP Application Services. Web Servers: Basic Operation, Virtual hosting, CGEnked transfers, Caching support, Extensibility. SGML, HTML5, CSS3. XML Languages and Applications: Core XML, XHTML, XHTM MP. Web Service: SOAP, REST, WML, XSL. Web Services: Operations, Processing HTTP Requests, Processing HTTP Responses, Cookie Coordination, Privacy and P3P, Complex

HTTP Interactions, Dynamic Content Delivery. Server Configuration. Server Security. Web Browsers Architecture and Processes. Active Browser Pages: JavaScript, DHTML, AJAX. JSON, Approaches to Web Application Development. Programing in any Scripting language. Search Technologies. Search Engine Optimization. XML Query Language, Semantic Web, Future Web Application Framework.

Reference Material:
1. Web Application Architecture: Principles, protocols and practices by Leon Shklar and Richard Rosen, Wiley; 2nd Edition (May 5, 2009). ISBN-10:047051860X
2. Web Technologies: A Computer Science Perspective by Jeffrey C. Jackson, Prentice Hall; 1st Edition (August 27, 2006). ISBN-10:0131856030

DIGITAL IMAGE PROCESSING

Credit hours: 4 (3, 1)   **Total Marks: 100**

Course Contents:
The GEman visual system, electromagnetic system, working and components inside digital camera, pixels, image representation, sampling, quantization, mathematics of image formation, convolution, camera projection, point-based image processing, Fourier theory, image filtering in spatial and frequency domain, wavelets, image registration, morphological operations, color models, multispectral images, feature detection, image segmentation, Pattern recognition, etc.

Reference Material:
1. Gonzalez R. C., Woods R. E., Eddins S. L., Digital Image Processing Using Matlab, Pearson Education, 2nd edition, 2009.
2. Gonzalez R. C., Woods R. E., Digital Image Processing, Pearson Education, 3rd edition, 2008.
3. Understanding Digital Signal Processing by Richard G. Lyons, Prentice Hall; 3rd edition, 2010.

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, IGRPand EIGRP, DHCP, the domain name system(DNS), and the WWW protocols.

Reference Material:
- *Computer Networks; 3rd 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

TECHNICAL & BUSINESS WRITING

Credit hours: 3   **Total Marks: 100**

Course Contents:
Overview of technical reporting, use of library and information gathering, administering questionnaires, reviewing the gathered information; Technical exposition; topical arrangement, exemplification, definition, classification and division, casual analysis, effective exposition, technical narration, description and argumentation, persuasive strategy, Organizing information and generation solution: brainstorming, organizing material, construction of the formal outline, outlining conventions, electronic communication, generation solutions. Polishing style: paragraphs, listening sentence structure, clarity, length and order, pomposity, empty words, pompous vocabulary, document design: document structure, preamble, summaries, abstracts, table of contents, footnotes, glossaries, cross-referencing, plagiarism, citation and bibliography, glossaries, index, appendices, typesetting systems, creating the professional report; elements, mechanical elements and graphical elements. Reports: Proposals, progress reports, Leaflets, brocGEres, handbooks, magazines articles, research papers, feasibility reports, project reports, technical research reports, manuals and documentation, thesis. Electronic documents, Linear verses hierarchical structure documents.

Reference Material:
1. Technical Report Writing, by Pauley and Riordan, Houghton Mifflin Company, 8th Edition.
2. Effective Technical Communication by Ashraf Rizvi, Tata McGraw-Hill.

SEMESTER-VII

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

THEORY OF PROGRAMMING LANGUAGES

Credit hours: 3   **Total Marks: 100**

Course Contents:
Introduction: Models of Computation, Syntax and Semantics, Pragmatics, Language Design Principles. Syntax and Semantics: Context-Free Grammars, Regular Expressions, Attribute Grammars and Static Semantics, Algebraic Semantics, Axiomatic Semantics, Denotational Semantics. BNF grammars and Syntax, Operational Equivalence, Abstraction and Generalization, Expressions, Assignment Statement, and Control Structures, Functional Programming: The Lambda Calculus, Operational Semantics, Reduction Order, Recursive Functions, Logic Programming, Inference Engine, Concurrency.

Reference Material:
1. Concepts of Programming Languages, Robert W. Sebesta, 10th edition, 2012
2. Scott, Michael L., Programming Language Pragmatics, 2nd edition, 2006
3. Theory Introduction to Programming Languages, by Anthony A. Aaby, 2004

PROJECT-I

Credit Hours: 0-3

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

NETWORK SECURITY

Credit hours: 3   **Total Marks: 100**

Course Contents:
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.

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.

BIG DATA ANALYTICS

Credit Hours: 3   **Total Marks: 100**

Course Contents:
Introduction to Big Data Analytics, Big Data Platforms, Data Store & Processing using Hadoop, Big Data Storage and Analytics, Big Data Analytics ML Algorithms, Recommendation, Clustering, and Classification, Linked Big Data: Graph Computing and Graph Analytics, Graphical Models and Bayesian Networks, Big Data Visualization, Cognitive Mobile Analytics.

Reference Materials:

1. Mining of Massive Datasets, Jure Leskovec, AnandRajaraman, Jeff Ullman, 2nd edition, 2011
2. Hadoop: The Definitive Guide, Tom White, 4th edition. 2009.
3. Data-Intensive Text Processing with Map Reduce, Jimmy Lin and Chris, 2010.

E-COMMERECE

Credit hours: 3   **Total Marks: 100**

Course Contents:

An overview of E-Commerce & its business models and concepts, Planning an E-Commerce Framework, Managing Products and Categories, Product Variations and User Uploads, Enhancing the User Experience, The Shopping Basket, The Checkout and Order Process, Shipping and Tax, Discounts, Vouchers, and Referrals, Checkout, Taking Payment for Orders, User Account Management, Administration: Dashboard, Managing Products and Categories, Managing Orders, Customers, Refunds, Voucher Codes, Shipping, Deploying, Security, and Maintenance, Web Payment Systems, Social, Legal, and Ethical Issues of E-Commerce, Auctions, Portals, and Communities, SEO.

Reference Materials:

1. E-Commerce, Kenneth Laudon and Carol Guercio Traver, 13th Edition, Pearson, 2017.
2. PHP 5 E-commerce Development, Michael Peacock, Packt Publishing, 2010.
3. Introduction to E-Commerce, Jeffrey F. Rayport, McGraw-Hill, 2nd Edition, 2007.
4. Electronic Commerce, Gary Schneider, Course Technology; 12th Edition 2016

SEMESTER-VIII

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:
1. Expert Systems and its Applications Understanding Artificial Intelligence

HUMAN COMPUTER INTERACTION

Credit hours: 4 (3, 1)   **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.
- 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:
1. About Face: The Essentials of Interaction Design, Alan Cooper, Robert Reimann, DavidCronin,
2. ChirstopherNoessel, 4th Ed, Wiley, 2014

PROFESSIONAL PRACTICES

Credit hours: 3   **Total Marks: 100**

Course Outline:

Computing Profession, Computing Ethics, Philosophy of Ethics. The Structure of Organizations, Finance and Accounting, Anatomy of a Software House, Computer Contracts, Intellectual Property Rights, The Framework of Employee Relations Law and Changing Management Practices, GEman Resource Management and IT, Health and Safety at Work, Software Liability, Liability and Practice, Computer Misuse and the Criminal Law, Regulation and Control of Personal Information. Overview of the British Computer Society Code of Conduct, IEEE Code of Ethics, ACM Code of Ethics and Professional Conduct, ACM/IEEE Software Engineering Code of Ethics and Professional Practice. Accountability and Auditing, Social Application of Ethics.

Reference Material:

1. Professional Issues in Software Engineering by Frank Bott, Allison Coleman, Jack Eaton and Diane Rowland, CRC Press; 3rd Edition (2000). ISBN-10: 0748409513
2. Computer Ethics by Deborah G. Johnson, Pearson; 4th Edition (January 3, 2009). ISBN-10: 0131112414

PROJECT-II

Credit hours: 3   **Total Marks: 100**

The project will be started in semester 7th but marks will be awarded in Semester 8

INFORMATION SECURITY

Credit hours: 3   **Total Marks: 100**

Course Outline:

Information security foundations, security design principles; security mechanisms, symmetric and asymmetric cryptography, encryption, hash functions, digital signatures, key management, authentication and access control; software security, vulnerabilities and protections, malware, database security; network security, firewalls, intrusion detection; security policies, policy formation and enforcement, risk assessment, cybercrime, law and ethics in information security, privacy and anonymity of data.

Reference Material:

1. Computer Security: Principles and Practice, 3rd edition by William Stallings
2. Principles of Information Security, 6th edition by M. Whitman and H. Mattord
3. Computer Security, 3rd edition by Dieter Gollmann
4. Computer Security Fundamentals, 3rd edition by William Easttom