

Kumaun University, Nainital, Uttarakhand
M.Sc. COMPUTER SCIENCE
(Choice Based Credit System)
w.e.f. Session 2020-2021

Year	Semester	Core Papers		Credits	Elective Papers (*)		Credits	Open Elective		Credits	Total Credits
		Paper Code	Title of Paper		Paper Code	Title of Paper		Paper Code	Title of Paper		
First	I	MSCS 101	Operating System Concepts & Administration	5X4=20	---	----	----	----	----	----	20
		MSCS 102	Theoretical foundation of Computing								
		MSCS 103	Advanced Computer Network								
		MSCS 104	Advanced Database Management Systems								
		MSCS L01	LAB: .NET C# & ADBMS								
	II	MSCS 201	Compiler Design	5X4=20	---	----	----	----	----	----	20
		MSCS 202	Design and Analysis of Algorithms								
		MSCS 203	Artificial Intelligence								
		MSCS 204	Software Engineering								
MSCS L02		LAB: DAA with JAVA									
Second	III	MSCS 301	Machine Learning	2X4=8	Elective I (**)		(2 papers out of 3)	As Per the Selected Course	To be selected from the list of open electives given by different departments	1X4=4	20
		MSCS L03	LAB: Machine Learning with Python/R		MSCS 302 (E1-a)	Data Mining with Python					
					MSCS 303 (E1-b)	Digital Image Processing with OpenCV					
					MSCS 304 (E1-c)	Cloud Computing					
					Elective II (**)						
					MSCS 302 (E2-a)	Internet of Things					
					MSCS 303 (E2-b)	Network Security and Cryptography					
	MSCS 304 (E2-c)	Cyber Security									
	IV	MSCS 401	Project Work/Dissertation	2X4=8	MSCS 403 (E)	Advanced Java	(2 paper out of 3)	As Per the Selected Course	To be selected from the list of open electives given by different departments	1X4=4	20
		MSCS 402	Viva-Voce		MSCS 404 (E)	Web Application Development					
					MSCS 405 (E)	Mobile App Development					

*	Students can choose any one pool of Elective Papers in Semester III either Elective I or Elective II
**	Student can choose only 2 subjects out of 3, either from Elective I or Elective II
OE	Open electives offered by Department of Computer Science
	MSCS 599 (OE) Programming in Python
	MSCS 699 (OE) Programming in R
	MSCS 799 (OE) Cyber Security Awareness

MSCS 101: Operating System Concepts & Administration

UNIT I

Introduction: Basics of Operating Systems: Definition – Generations of Operating systems – Types of Operating Systems, OS Service, System Calls.

Process Management: Processes: Definition, Process Relationship, Process states, Process State transitions, Process Control Block, Context switching – Threads – Concept of multithreads.

Process Scheduling: Definition, Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time (Definition only), Scheduling algorithms: Pre-emptive and Non, pre-emptive, FCFS – SJF – RR

UNIT II

Inter-process Communication: Race Conditions, Critical Section, Mutual Exclusion, Peterson's Solution, The Producer Consumer Problem, Semaphores, Classical IPC Problems: Reader's & Writer Problem, Dining Philosopher Problem etc.

Deadlocks: Definition, Deadlock characteristics, Deadlock Prevention, Deadlock Avoidance: banker's algorithm, Deadlock detection and Recovery.

UNIT III

Memory Management: Basic Memory Management: Definition, Logical and Physical address map, Memory allocation: Contiguous Memory allocation, Fixed and variable partition, Internal and External fragmentation and Compaction, Paging: Principle of operation, Page allocation, Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory, Hardware and control structures, Locality of reference, Page fault, Working Set, Dirty page/Dirty bit, Demand paging (Concepts only), Page Replacement policies: Optimal (OPT), First in First Out (FIFO, Least Recently used (LRU).

UNIT IV

I/O Management & Disk Scheduling: I/O Devices and the Organization of I/O Disk I/O, Operating System Design Issues. File System: File Concept, File Organization and Access Mechanism, File Directories, File Sharing, Implementation Issues.

UNIT V

Unix Administration: Overview of System Administration – System Administrator Responsibilities, A Brief History of Unix. User Administration – what is a user, the /etc/passwd file, groups, the /etc/group file, passwords adding, deleting and modifying user attributes, /etc/profile file, the login process, /etc/motd file, the wall command. File System Basic - The Hierarchy, files, directories, device files, character and block devices, the /dev directory, links, symbolick links, a file system tour, df command, du command, find command. Disk Management – Making a file system, mkfs command, mount command fstab file, fsck command, lost+found directory, prtvtoc command. Unix Process – overview, process space, process table, fork/exec mechanism, ps command, background process, kill command, scheduling jobs, the cron daemon, at command, crontab command, cron files. Configuring TCP/IP - /etc/hosts file, ifconfig command. /etc/services/ file, inetd daemon, /etc/inetd.conf, TCP/IP troubleshooting, the ping and netstat commands. Network Utilities- Network Services, telnet, ftp, rcp, rlogin, rsh.

Recommended Books:

1. Stalling, William, "Operating System", Maxwell Macmillan
2. Silveschatza, Peterson J, "Operating System Concepts", Willey.
3. A Silberschatz, P B. Galvin, G. Gagne, Operating Systems Concepts, 8th Edition, John Wiley Publications.

MSCS 102: Theoretical foundation of Computing

UNIT I

Introduction to defining language, Kleene closures, Arithmetic expressions, defining grammar, Chomsky hierarchy, Finite Automata (FA), Transition graph, generalized transition graph.

UNIT II

(Nondeterministic finite Automata (NFA), Deterministic finite Automata (DFA), Construction of DFA from NFA and optimization, FA with output: Moore machine, Mealy machine and Equivalence, Applications and Limitation of FA.

UNIT III

Arden Theorem, Pumping Lemma for regular expressions, Myhill-Nerode theorem, Context free grammar: Ambiguity, Simplification of CFGs, Normal forms for CFGs, Pumping lemma for CFLs, Decidability of CFGs, Ambiguous to Unambiguous CFG.

UNIT IV

Push Down Automata (PDA): Description and definition, Working of PDA, Acceptance of a string by PDA, PDA and CFG, Introduction to auxiliary PDA and Two stack PDA.

UNIT V

Turing machines (TM): Basic model, definition and representation, Language acceptance by TM, TM and Type – 0 grammar, Halting problem of TM, Modifications in TM, Universal TM, Properties of recursive and recursively enumerable languages, unsolvable decision problem, undecidability of Post correspondence problem, Church's Thesis, Recursive function theory

Recommended Books:

1. Hopcroft, Ullman, "Introduction to Automata Theory, Language and Computation", Nerosa Publishing House, 3rd Edition
2. K.L.P. Mishra and N.Chandrasekaran, "Theory of Computer Science(Automata, Languages and Computation)", PHI, 3rd Edition

MSCS 103: Advanced Computer Networks

UNIT I

Introduction: Overview of computer network, seven-layer architecture, TCP/IP suite of protocol, etc. Mac protocols for high-speed LANS, MANs& WIRELESS LANS. (For example, FDDI, DQDB, HIPPI, Gigabit Ethernet, Wireless Ethernet etc.) Fast access technologies. (For example, ADSL, Cable Modem, etc.)

UNIT II

IPv6: why IPv6, basic protocol, extension & option, support for QoS, security etc., neighbor discovery, auto-configuration, routing. Change to other protocols. Application programming interface forIPv6. 6bone.

UNIT III

Mobility in network. Mobile. Security related issues. IP Multicasting. Multicasting routing protocols, address assignments, session discovery, etc. TCP extensions for high-speed networks, transaction- oriented application, other new options in TCP.

UNIT IV

Network security at various layers. Secure-HTTP, SSL, ESP, Authentication header, Key distribution protocols. Digital signatures, digital certificates.

UNIT V

Study of complete network architecture of your institution (including topology, network devices cabling standards, protocol and security features). Hands on experiment for configuring network interface card for connecting two systems. Test the connectivity between two hosts. Test all options of ping.

Recommended Books:

1. W. R. Stevens, "TCP/IP illustrated, Volume 1: The protocols", Addison Wesley 1994.
2. G.R. Wright. "TCP/IP illustrated, Volume 2: The implementation", Addison Wesley 1995
3. Forouzen, "Data Communication and Networking", TMH
4. W. Stallings, Data and Computer Communication, Macmillan Press

MSCS 104: Advanced Database Management Systems

UNIT I

Introduction: An overview of Database systems, Architecture, Schema and Instances, Data Independence and Data Base. Entity-Relationship Diagram, generalization, aggregation and association, Data Models: Hierarchical, Network and Relational.

UNIT II

Relational data model concepts, Integrity constraints, keys, Domain Constraints, Referential Integrity, Assertions, Triggers, Foreign key, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Reduction of Relation Algebra to Relational Calculus, Relation Completeness.

UNIT III

Functional Dependencies, normal forms (1NF, 2NF, 3NF), BCNF, Multivalued Dependencies, 4NF, Join Dependencies and 5NF. Query processing and optimization. Transaction processing concepts.

UNIT IV

Transaction systems, schedule and recoverability, Testing of serializability, Serializability of schedules, conflicts. Concurrency control techniques: Locking techniques for concurrency control, Time stamping protocols validation techniques, multiple granularity, multiversion schemes.

UNIT V

Distributed database: Distributed data storage, data fragmentation, replication and allocation techniques for distributed database design, recovery in distributed database, protection and security.

Recommended Books:

1. Elmasri, Navathe, "Fundamentals of Database Systems", Pearson Education.
2. Korth, Silbertz, Sudarshan," Database Concepts" McGraw Hill
3. C.J. Date, "An Introduction to Database Systems" Addison Wesley
4. Bipin C. Desai," An Introduction to Database Systems", Galgotia Publication
5. Mazumdar and Bhattacharya, "Database Management Systems", TMH
6. Ramakrishnan, Gehrke," Database Management System", McGraw Hill.

MSCS 201: Compiler Design

UNIT I

INTRODUCTION TO COMPILERS: Translators-Compilation and Interpretation-Language processors -The Phases of Compiler-Errors Encountered in Different Phases-The Grouping of Phases-Compiler Construction Tools - Programming Language basics

UNIT II

LEXICAL ANALYSIS: Need and Role of Lexical Analyzer-Lexical Errors-Expressing Tokens by Regular Expressions-Converting Regular Expression to DFA- Minimization of DFA-Language for Specifying Lexical Analyzers-LEX-Design of Lexical Analyzer for a sample Language.

UNIT III

SYNTAX ANALYSIS: Need and Role of the Parser-Context Free Grammars -Top Down Parsing -General Strategies-Recursive Descent Parser Predictive Parser-LL (1) Parser-Shift Reduce Parser-LR Parser-LR (0) Item-Construction of SLR Parsing Table -Introduction to LALR Parser - Error Handling and Recovery in Syntax Analyzer

UNIT IV

SYNTAX DIRECTED TRANSLATION RUN TIME ENVIRONMENT: syntax directed Definitions-Construction of Syntax Tree-Bottom-up Evaluation of S-Attribute Definitions- Design of predictive translator - Type Systems-Specification of a simple type checker-Equivalence of Type Expressions-Type Conversions. RUN-TIME ENVIRONMENT: Source Language Issues-Storage Organization-Storage Allocation-Parameter Passing-Symbol Tables-Dynamic Storage Allocation

UNIT V

CODE OPTIMIZATION AND CODE GENERATION: Principal Sources of Optimization-DAG- Optimization of Basic Blocks-Global Data Flow Analysis-Efficient Data Flow Algorithms-Issues in Design of a Code Generator - A Simple Code Generator Algorithm

Recommended Books:

1. Aho, Sethi & Ullman, "Compiler Design", Addison Wesley/ Pearson.
2. O. G. Kakde; Compiler Design,4/e; Universities Press (2008)
3. Chattopadhyay Santanu; Compiler Design; Phi Learning (2009)

MSCS 202: Design and Analysis of Algorithms

UNIT I

Algorithms, Analysis of Algorithm, Design of Algorithms, Time and space complexities, Asymptotic notations, Growth+ of Functions, Recurrences. Sorting in Polynomial Time: Insertion Sort, Merge Sort, Heap sort and Quick Sort. Sorting in Linear Time: Counting Sort, Radix Sort, Bucket Sort

UNIT II

Elementary Data Structure: Stacks, Queues, Linked List, Binary Search Tree, Hash Table, Red Black Trees, AVL Tree, Splay Tree, Augmenting Data Structure Advanced Data Structure: Binomial Heap, B-tree, Fibonacci Heap, and Data Structure for Disjoint sets.

UNIT III

Advanced Design and Analysis Techniques: Dynamic Programming, Greedy Algorithm, Backtracking, Branch-and-Bound. Huffman Coding.

UNIT IV

Graph Algorithms: Elementary Graph Algorithm, Breadth First Search, Depth First Search, Minimum Spanning Tree, Kruskal's Algorithm, Prim's Algorithm, Single Source Shortest Path, All Pair Shortest Path, Maximum Flow and Travelling Salesman Problem.

UNIT V

Randomized Algorithm: String Matching, NP-Hard and NP- Completeness, Approximation Algorithms.

Recommended Books:

1. Horowitz Sahni, "Fundamentals of Computer Algorithm", Galgotia,
2. Coreman Leiserson etal, "Introduction to Algorithm", PHI
3. Brassard Bratley, "Fundamental of Algorithm", PHI
4. M.T. Goodrich etal, "Algorithms Design", John Wiley and Sons
5. A V. Aho etal, "The Design and Analysis of Algorithms", Pearson Education

MSCS 203: Artificial Intelligence

UNIT I

Early work in AI, AI and related fields, Problem Solving Introduction, State space search, Production system, Breadth First Search, Depth First Search, Problem Characteristics, Heuristic Search-Generate and Test, Simple Hill climbing, Path Finding Algorithm

UNIT II

Knowledge representation, Definition and Importance of Knowledge, Knowledge based system, Representation of knowledge, Introduction of predicate logic, Well-formed formula, Inference rule and numerical, The Resolution principle, Representation using rule.

UNIT III

Natural Language Processing: Introduction, Problems in Natural Language Understanding, Overview of Linguistics, Grammars and Languages, Natural Language Generation, Natural Language Systems, Top-Down Parser, Bag of Words Model.

UNIT IV

Evolutionary Computation, Genetic Algorithms, Terminologies and Operators of GA, Ant Colony Optimization, Particle Swarm Optimization, GA Tool using MATLAB.

UNIT V

Introduction, Need and Justification of Expert System, Knowledge Acquisition, Knowledge System building tools, Basic steps of Expert System Development, Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Decision Making

Recommended Books:

1. Elia Rich and Kelvin Knight, "AI", TMH
2. Dan W. Patterson, "Introduction to Artificial Intelligence and Expert Systems"
3. K M FU, "Neural Network in Computer Intelligence", Mc Graw Hill
4. Russel and Norvig, "AI: A modern approach", Pearson Education

MSCS 204: Software Engineering

UNIT I

Introduction: Software Engineering vs. Traditional Programming, System Development Life Cycle (Software Production Process, Conception, Initiation, Analysis Design, Construction, Testing, Implementation). Waterfall Model, Evolutionary Model. Factors affecting Software Development and Maintenance.

UNIT II

Software Project Management: Defining the Problem, developing a Solution Strategy, Planning the Development Process, Measurement of Software Productivity and Quality.

UNIT III

Software Engineering Principles & Tools: Tools of Design (Data Flow Diagrams, Data Dictionary, Decision Tree, Decision Tables), Modularization (Coupling)

UNIT IV

Testing: Testing fundamentals, Unit testing, Blackbox testing, Whitebox testing, Basic Path testing, Control Structure testing, Integration testing.

UNIT V

Software maintenance: Introduction to Software Maintenance, Enhancing Maintainability During Development (analysis Activities, Standards and Guidelines, Design activities, Implementation Activities, Supporting Documents) Managerial Aspects of Software Maintenance (Change Control Board, Change Request summaries, Quality Assurance Activities, Organizing Maintenance Programs).

Recommended Books:

1. R.F.Fairley,, "Software Engineering Concepts", McGraw Hill.
2. R.S.Press Man , "Software Engineering A Practitioners Approach" McGraw Hill.
3. Rajib Mall, "Fundamentals of Software Engineering". PHI.
4. Pankaj Jalote. "An Integrated Approach to Software Engineering", Narosa

MSCS 301: Machine Learning

UNIT I

Introduction: Machine Learning Definitions, Application of Machine Learning, Problems, Data and Tools, Python for Machine Learning, Data Pre-processing in Python

UNIT II

Regression: Linear Regression-Simple, Multiple, Polynomial Regression, Support Vector Regression, Regression Trees, Evaluating Regression Models Performance

UNIT III

Classification: Logistic Regression, K-Nearest Neighbors (K-NN), SVM, Naïve Bayes, Decision tree and Random Forest

UNIT IV

Convolution Neural Networks: What is Convolutional Neural Network, Foundation of Convolutional Neural Network, ResNet Case Study, Object Detection, Application: Face Recognition and Style Transfer

UNIT V

Neuro - Fuzzy Modeling: Adaptive Neuro-Fuzzy Inference Systems, Coactive Neuro-Fuzzy Modeling, Rule base Structure Identification, ANFIS Applications using MATLAB.

Recommended Books:

1. Machine Learning Algorithms by Giuseppe Bonaccorso
2. Hands-on Machine Learning with Scikit-Learn, Keras& TensorFlow
3. Make Your Own Neural Network by Tariq Rashid
4. Neural Networks Math A Visual Introduction for Beginners by Michael Taylor

MSCS 302 (E1-a): Data Mining with Python

Unit I

DSS-uses, Definition, Operational Database, Introduction to DATA Warehousing, Data-Mart, Concept of Data-Warehousing, Multidimensional Database Structures. Client/server computing model & Data Warehousing. Parallel Processors & cluster Systems. Distributed DBMS implementations.

Unit II

Data warehousing. Data Warehousing components. Building a Data Warehouse. Warehouse Database Mapping the Data Warehouse to Multiprocessor Architecture. DBMS Schemas for Decision Support. Data Extraction, Clean-up & Transformation Tools. Metadata.

Unit III

Business Analysis. Reporting & Query Tools & Applications. Online Analytical Processing (OLAP). Patterns & Models. Statistics. Artificial Intelligence.

Unit IV

A brief introduction to python language, literals, functions, operators, anonymous functions. Introduction to Python packages for data science-NumPy, pandas, Keras and cubes.

Unit- V

Knowledge Discovery, Data Mining. Introduction to Data-Mining. Techniques of Data-Mining. Decision Trees. Neural Networks. Nearest Neighbour. & clustering. Genetic Algorithms., Implementation of these techniques in Python.

Recommended Books:

1. Introduction to Data Mining Tan, Steinbach, & Kumar Pearson-Addison Wesley 2006
2. Data Mining: Practical Machine Learning and Techniques (2nd eds) Witten & Frank Elsevier 2005
3. Data Mining Techniques: For Marketing, Sales, and Customer Relationship Management (2nd eds) Berry & Linoff Wiley 2004
4. Pattern Recognition & Machine Learning Bishop Springer 2007
5. Data Mining and Data Warehousing: Principles and Practical Techniques
6. Mastering Data Mining with Python - Find patterns hidden in your data
7. Data Science Using Python and R

MSCS 303 (E1-b): Digital Image Processing with OpenCV

Unit I

Introduction: Digital Image Processing System, Image Perception, Colour Representation, Image Acquisition, Image Digitization, Image model, Image scanning techniques, Noise, Image Processors, A brief overview of OpenCV, Installing OpenCV in Windows, Linux, how are Image formed and stored.

Unit II

Statistical Operation: Gray Level Transformation, Histogram Processing, Grey Level Transformation Techniques, Multi Image Operations, OpenCV-Gray scaling, histogram representation of images, drawing over images, Transformation, Scaling, Cropping, Darkening/Brightening Images, Masking Blurring and Sharpening.

Unit III

Segmentation and Edge Detection: Segmentation, Region Based Segmentation, Thresholding, Basic Edge Detection, Colour Edge Detection, Pyramid Edge Detection, OpenCV – Edge Detection using Image Gradient, Segmentation and Contours, Link Detection, Circle Detection and Blob Detection.

Unit IV

Object Recognition: System Component, Complexity of Object Recognition, Object Representation, Feature Detection, Recognition Strategies. OpenCV-Finding Corners, Extracting Features, Face Detection using HAAR's Cascade.

Unit V

Image Compressions: Introduction to Image compression, Basic Requirements, Different Types of Compressions, Coding algorithms: Run Length Coding, Huffman Coding LZW, JPEG

Recommended Books:

1. S. Nagabhushana, "Computer Vision and Image Processing", New Age International Publishers.
2. Rosenfield, "Digital Picture Processing", KAK Academic Press Orlando
3. Gonzalez and Wintz, "Digital Image Processing", Addison Wesley

MSCS 304 (E1-c): Cloud Computing

UNIT I

Cloud Computing Overview, Recent trends in Computing, Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing,

UNIT II

Introduction to Cloud Computing, History of Cloud Computing, Cloud service providers, Benefits and limitations of Cloud Computing,

UNIT III

Cloud Computing Architecture, Comparison with traditional computing architecture (client/server), Services provided at various levels, Service Models- Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), How Cloud Computing Works, Deployment Models- Public cloud, Private cloud, Hybrid cloud, Community cloud, Case study of NIST architecture.

UNIT IV

Service Management in Cloud Computing, Service Level Agreements (SLAs), Billing & Accounting, Comparing Scaling Hardware: Traditional vs. Cloud, Economics of scaling.

UNIT V

Cloud Security: Infrastructure Security- Network level security, Host level security, Application level security, Data security and Storage- Data privacy and security Issues, Jurisdictional issues raised by Data location, Authentication in cloud computing.

Recommended Books:

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
2. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010
3. Gautam Shroff, Enterprise Cloud Computing Technology Architecture Applications, Adobe Reader ebooks available from eBooks.com, 2010
4. Toby Velte, Anthony Velte, Robert Elsenpeter, Cloud Computing, A Practical Approach, McGraw Hills, 2010.
5. Dimitris N. Chorafas, Cloud Computing Strategies, CRC Press, 2010.

MSCS 302 (E2-a): Internet of Things

UNIT I

OVERVIEW: IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking

UNIT II

REFERENCE ARCHITECTURE: Reference Model and architecture, IoT reference Model - IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. Real-World Design Constraints- Introduction, Technical Design constraints- hardware is popular again, Data representation and visualization, Interaction and remote control.

UNIT III

IOT DATA LINK LAYER & NETWORK LAYER PROTOCOLS: PHY/MAC Layer (3GPP MTC, IEEE 802.11, IEEE 802.15), Wireless HART, Z Wave, Bluetooth Low Energy, Zigbee Smart Energy, DASH7 - Network Layer-IPv4, IPv6, 6LoWPAN, 6TISCH, ND, DHCP, ICMP, RPL, CORPL, CARP

UNIT IV

TRANSPORT & SESSION LAYER PROTOCOLS: Transport Layer (TCP, MPTCP, UDP, DCCP, SCTP)- (TLS, DTLS) – Session Layer HTTP, CoAP, XMPP, AMQP, MQTT

UNIT V

SERVICE LAYER PROTOCOLS & SECURITY: Service Layer -oneM2M, ETSI M2M, OMA, BBF – Security in IoT Protocols – MAC 802.15.4, 6LoWPAN, RPL, Application Layer

Recommended Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, “From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence”, 1st Edition, Academic Press, 2014.
2. Peter Waher, “Learning Internet of Things”, PACKT publishing, BIRMINGHAM – MUMBAI
3. Vijay Madiseti and ArshdeepBahga, “Internet of Things (A Hands-onApproach)”, 1 st Edition, VPT, 2014.

MSCS 303 (E2-b): Network Security and Cryptography

Unit I

An illustrative communication game – safeguard versus attack – Probability and Information Theory - Algebraic foundations – Number theory.

Unit II

Substitution Ciphers – Transposition Ciphers – Classical Ciphers – DES – AES – Confidentiality Modes of Operation – Key Channel Establishment for symmetric cryptosystems.

Unit III

Diffie-Hellman Key Exchange protocol – Discrete logarithm problem – RSA cryptosystems & cryptanalysis – ElGamal cryptosystem – Need for stronger Security Notions for Public key Cryptosystems – Combination of Asymmetric and Symmetric Cryptography – Key Channel Establishment for Public key Cryptosystems - Data Integrity techniques – Symmetric techniques - Asymmetric techniques

Unit IV

Authentication Protocols Principles – Authentication protocols for Internet Security – SSH Remote logic protocol – Kerberos Protocol – SSL & TLS – Authentication frame for public key Cryptography – Directory Based Authentication framework – Non - Directory Based Public-Key Authentication framework.

Unit V

Protecting Programs and Data – Information and the Law – Rights of Employees and Employers – Software Failures – Computer Crime – Privacy – Ethical Issues in Computer Security.

Recommended Books:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", PHI
2. A. Johannes Buchmann, "Introduction to Cryptography", Springer- Verlag
3. Atul Kahate, "Cryptography and Network Security"
4. Cryptography and Network Security by Forouzan

MSCS 304 (E2-c): Cyber Security

Unit I

Introduction to Cyber Security: Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats: - Cyber Warfare-Cyber Crime-Cyber Terrorism-Cyber Espionage, need for a Comprehensive Cyber Security Policy, need for a Nodal Authority, Need for an International convention on Cyberspace.

Unit II

Cyber Security Vulnerabilities and Cyber Security Safeguards: Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.

Unit III

Securing Web Application, Services and Servers: Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.

Unit IV

Intrusion Detection and Prevention: Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion Detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion Prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.

Unit V

Cryptography and Network Security: Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security, Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer- IPsec.

Recommended Books:

1. Cyber Security by Nina Godbole Sunit Belapure
2. Cybersecurity - Attack and Defense Strategies: Infrastructure security with Red Team and Blue Team tactics by Yuri Diogenes
3. Cryptography and Network Security by Forouzan
4. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws by Dafydd Stuttard

MSCS 403(E): Advance Java

UNIT I

Revising the Basics: Java Environment, Basic Language Elements-Lexical Tokens, Identifiers, Keywords, Literals, Comments, Primitive Datatypes, Operators Assignments, OOPs Concepts-Class and Interfaces, Fundamental, Object Lifetime and Garbage Collection, Constructors, Access Control, Overloading, “this” reference, Inheritance.

UNIT II

Java Advanced: Packages – Organizing Classes and Interfaces in Packages, Defining Packages, CLASSPATH Setting for Packages, Making JAR Files for Library Packages Import, Array and String, Exception Handling, Multithreading, Collection Framework.

UNIT III

Java Server Technologies: Web Application Basics, Architecture and challenges of Web Application, Introduction to servlet, Servlet life cycle, Developing and Deploying Servlets, Exploring Deployment, Descriptor, Handling Request and Response.

UNIT IV

Java Serve Pages: Basics of JSP-JSP API, JSP in IDE's, Scripting elements, 9 Implicit Objects, Directive Elements, Action Elements.

UNIT V

Overview of Mail Protocols-SMTP, POP3, IMAP, Sending Mail, sending email through Gmail Server, Receiving Email, Sending HTML content.

Recommended Books:

1. Murachs Java Servlets & JSP (Murach: Training & Reference)
2. Head First Servlets & JSP: Passing the Sun Certified Web Component Developer Exam
3. Web Development with Java: Using Hibernate, JSPs and Servlets Kindle Edition

MSCS 404(E): Web Application Development

UNIT I

Introduction to HTML: Basics of HTML, formatting and fonts, commenting code, hyperlink, lists, tables, images, forms, Meta tags, Character entities, frames and frame sets, Overview and features of HTML5.

UNIT II

Style Sheets: Need for CSS, Introduction to CSS, basic syntax and structure, using CSS, background images, colours and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2, Overview and features of CSS3

UNIT III

Introduction to JavaScript: JavaScript Variables and Data Types, Declaring Variables, Data Types, Statements and Operators, Control Structures, Conditional Statements, Loop Statements, Object-Based Programming, Functions, Executing Deferred Scripts, Objects, Message box in JavaScript, Dialog Boxes, Alert Boxes, Confirm Boxes, Prompt Boxes, JavaScript with HTML, Events, Event Handlers, Forms, Forms Array.

UNIT IV

Node JS: Introduction to Node JS, Setup Development Environment, Node JS Modules, Node Package Manager, Creating Web Server, File System, Debugging Node JS Application, Events, Express JS, Serving Static Resources

UNIT V

Node JS Database Connectivity: Connecting String, Configuring, working with Select Command, Updating Records, Deleting Records.

Recommended Books:

1. Jeffrey C. Jackson, "Web Technologies: A Computer Science Perspective", Prentice Hall, 2007
2. JavaScript: The Good Parts by Douglas Crockford
3. HTML5 for Web Designers by Jeremy Keith
4. The Art and Science of CSS: Create Inspirational, Standards-Based Web Designs by Cameron Adams
5. Beginning Node.js by Basarat Ali Syed
6. Getting MEAN with Mongo, Express, Angular, and Node by Simon Holmes

MSCS 405(E): Mobile App Development

UNIT I

Android Architecture Overview: The Android Software Stack, The Linux Kernel, Android Runtime - Dalvik Virtual Machine, Android Runtime – Core Libraries, Dalvik VM Specific Libraries, Java Interoperability Libraries, Android Libraries, Application Framework.

UNIT II

Introduction to Android Studio: Introduction, Installation, Tour of Android Studio, Designer Features – Button, Text Fields, Messages. Running an Emulator, running on a Physical Android Device, Debugging.

UNIT III

Media: Images, Video and Sound: Layout, Animations, Video, Audio- Controlling Audio, Audio Volume Seeking, Grid Layout, WebView, List View.

UNIT IV

Advanced Android Features: Downloading Web Content, Downloading Images, Parsing JSON Data, Maps and Geolocation, Permanent Storage, SQLite.

UNIT V

A Popular Social Media App Clone: Clone of Any one of the popular social media app: Like Twitter, Instagram, Snapchat.

Recommended Books:

1. Android App Development All-in-One for Dummies, 3ed
2. Android Application Development, Black Book
3. Android Studio IDE Quick Reference

MSCS 599 (OE): Programming in Python

Unit I

Introduction to Python: An introduction to the Python programming language. Covers details of how to start and stop the interpreter and write programs. Introduces Python's basic data types, files, functions, and error handling. **Working with Data:** A detailed tour of how to represent and work with data in Python. Covers tuples, lists, dictionaries, and sets

Unit II

Program Organization and Functions: More information about how to organize larger programs into functions. A major focus of this section is on how to design functions that are reliable and can be easily reused in other settings. Also covers technical details of functions including scoping rules, documentation strings, and anonymous functions.

Unit III

Classes and Objects: An introduction to object-oriented programming in Python. Describes how to create new objects, overload operators, and utilize Python special methods. Also covers basic principles of object-oriented programming including inheritance and composition.

Unit IV

Iterators and Generators: Covers the iteration protocol, Iterable objects, generators and generator expressions. A major focus of this section concerns the use of generators to set up data processing pipelines--a particularly effective technique for addressing a wide variety of common systems programming problems (e.g., processing large data files, handling infinite data streams, etc.).

Unit V

Testing and Debugging: This section discusses many issues related to Python software development. This includes effective use of program testing using both the doc test and unit test modules, and effective use of assertions. The Python debugger and profiler are also described.

Recommended Books:

1. Python the Complete Reference, Martin C. Brown
2. Learn Python 3 The Hard Way, Zed A. Shaw
3. Python Essential Reference, David M. Beazley

MSCS 699 (OE): Programming in R

UNIT I

Overview of R, Installing R in windows and Linux, R Basics – Math, Variables and Strings.

UNIT II

Vectors and Factors, Vector Operation, Arrays & Matrices, Lists, Data frames, Working with Data frames.

UNIT III

Control Structures, Functions, Scoping Rules, Dates and Times, Loop Functions, Object and Classes
Debugging tools.

UNIT IV

Reading CSV and Excel Files, reading text files, Writing and Saving data objects to file in R, String Operations in R, Regular Expressions, Dates in R.

UNIT V

Brief overview of Data Science with R, Regression-Simple, Logistics, Polynomial. Classification-K-Nearest Neighbor, Decision Tree.

Recommended Books:

1. R Programming for dummies
2. R in action
3. Beginning R: The Statistical Programming Language
4. Practical Data Science with R (MANNING)

MSCS 799 (OE): Cyber Security Awareness

Unit I

Basic of computer and Cyber Security-History of Computers, Areas of Application, Computers and its components, Application Software and System Software, Introduction to Operating System

UNIT II

Basics of Networks and internet, Types of Network, Definition of Cyber Security, Search Engines, E –mails and WWW, Internetworking Devices, Internet Service provider, IP Address, Working of Email system, Domain Name System, Peer to peer sharing.

UNIT III

Overview of Security threats, Hacking Techniques-Password cracking, Insecure Network connections, Malicious code, Concept of Fire wall Security, Email security- web authentication

UNIT IV

Information Technology Law (Cyber Law), Evolution of the IT Act, Genesis and Necessity, Salient features of the IT Act, 2000, various authorities under IT Act and their powers, Penalties & Offences.

UNIT V

Sensitive Personal Data or Information (SPDI) in Cyber Law, SPDI Definition and Reasonable Security Practices in India, Reasonable Security Practices – International perspective, Cloud Computing & Law.

Recommended Books:

1. Cyber Security by Nina Godbole Sunit Belapure
2. Cybersecurity - Attack and Defense Strategies: Infrastructure security with Red Team and Blue Team tactics by Yuri Diogenes
3. Cryptography and Network Security by Forouzan
4. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws by Dafydd Stuttard