Course Structures & Syllabi

for

~~***Bachelor of Science (B.Sc.) Hons. in Computer Science***~~

✓ ***Master of Science (M.Sc.) in Computer Science***

~~***Master of Computer Applications (M.C.A.)***~~

~~***Doctor of Philosophy (Ph.D.)***~~

(Applicable for the students admitted w.e.f. academic session 2023-24)

Department of Computer Science

Maharaja Suhel dev State University, Azamgarh

Final

M.S.D. State University, Azamgarh (U.P.)

M.Sc. (COMPUTER SCIENCE) TWO YEAR (SEMESTER SYSTEM)

COURSE STRUTURE AND SYLLABUS

w.e.f. 2023& onwards

3/10/2023.

M. S. D. State University, Azamgarh
Syllabus

Semester Courses of M.Sc. (Computer Science) Based on CBCS

Academic Summary

COURSEOBJECTIVE:

1. To insulate the students from fast obsolescenceof computer technology by way of imparting fundamental knowledge,thinkingskillsand technicalskillsforsuperior mastery inthe areas ofcomputer science and itsapplications,
2. Enablethestudentstobewellplacedinleadingbusiness organizationsanywhereintheworld.

COURSE DURATION:The course duration is of 24 months spread over four Semesters with credit hours as per theWBUT norms.The course has sufficient emphasis on computing skills as well along with its science and managementparts.

COURSE CURRICULUM PLAN:The Course Curriculum is based on comparative analysis of existing MCA andMSc Computer Science curriculums of other Universities. The curriculum has sufficient exposure to hands-on skills andis much more directed towards higher employability. It is also well suited for upward accommodation of sciencegraduates and BCAgraduates.

Summary

SemesterNo	Contacthr/wk	Credit
1	29	23
2	33	26
3	29	26
4	28	20
Total		92

1. Detailed structure course

Semester-I

A.THEORY							
S.NO.	CODE	THEORY	CONTACTSPERIODS/WEEK				CREDITS
			L	**T**	**P**	**TOTAL**	
1	MCS101	Programming in C++	4	1	-	5	4
2	MCS102	AdvancedDBMS	3	1	-	4	3
3	MCS103	Information Systems & SoftwareEngineering	3	1	-	4	3
4	MCS104	Discrete Mathematics & NumericalMethods	3	1	-	4	3
5	MCS105	AdvancedComputerArchitecture	3	0	-	3	3
6	MCS106	Advanced OperatingSystem	3	-	-	3	3
TotalofTheory						**23**	**19**
B.PRACTICAL (Practical Lab-1)							
6	MCS191	ProgrammingLab(C++) Lab	-	-	3	3	2
7	MCS192	AdvancedDBMSLab	-	-	3	3	2

8	MCS193	OSLab(Unix)	-	-	3	3	2
TotalofPractical						**9**	**4**
TotalofSemester						**32**	**25**

Semester -II

A.THEORY							
SL. NO.	**CODE**	**THEORY**	**CONTACTSPERIODS/WEEK**				**CREDITS**
			L	**T**	**P**	**TOTAL**	
1	MCS201	ObjectOrientedAnalysis&Java Programming	3	1	-	4	3
2	MCS202	DataStructure	3	1	-	4	3
3	MCS203	Design and Analysis of Algorithms	3	1	-	4	3
4	MCS204	DataCommunication&Networking	3	1	-	4	3
5	MCS205	Compiler Design	3	-	-	3	3
6	MCS206	Computer Graphics	4	1	-	5	4
TotalofTheory						**24**	**19**

B.PRACTICAL (Practical Lab-2)							
6	MCS291	ObjectOrientedProgramming JavaLab	-	-	3	3	2
7	MCS292	DataStructureLab	-	-	3	3	2
8	MCS293	Microprocessorand Micro Controller Lab	-	-	3	4	3
TotalofPractical						**10**	**7**
TotalofSemester						**33**	**26**

Semester -III

A.THEORY							
S. NO.	**CODE**	**THEORY**	**CONTACTSPERIODS/WEEK**				**CREDITS**
			L	**T**	**P**	**TOTAL**	
1	MCS301	OperationResearch	2	1	-	3	2
2	MCS302	Software Engineering	2	1	-	3	2
3	MCS303	SoftComputing (artificial intelligence is covered in here)	3	1	-	3	3
4	MCS304	Data Mining and Warehousing	2	1	-	3	2
5	MCS305	Visual and Dot Net (.NET) Programming	3	1	-	4	3
6	MCS306	Data Science and big data tools	3	1	-	4	3
Elective–1 (Any one of the following)							
7	MCSE301A	EmbeddedSystems	2	1	-	3	2
8	MCSE301B	ImageProcessing	2	1	-	3	2

9	MCSE301C	Data Compression	2	1	-	3	2
10	MCSE301D	Python	2	1	-	3	2
TotalofTheory						**23**	**17**
B.PRACTICAL ((Practical Lab-3)							
10	MCS391	ORLab	-	-	2	2	2
11	MCS392	Visual and Dot Net (.NET) Lab	-	-	2	2	2
12	MCS393	Data Science and big data tools Lab	-	-	2	2	2
13	MCS394	Seminar	-	-	-	2	2
14	MCS395	IndustrialTraining	-	-	-	-	3
TotalofPractical						**08**	**11**
TotalofSemester						**31**	**28**

Semester -IV

A.THEORY							
SL. NO	**CODE**	**THEORY**	**CONTACTS PERIODS/WEEK**				**CREDITS**
			L	**T**	**P**	**TOTAL**	
1	MCS401	Artificial and deep Neural network	3	1	-	4	3
Elective–2(Any one of the following)							
2	MCSE401A	CloudComputing	3	1	-	4	3
3	MCSE401B	MobileComputing	3	1	-	4	3
4	MCSE401C	NetworkSecurity	3	1	-	4	3
5	MCSE401D	Basic Graph Theory	3	1	-	4	3
6	MCSE401E	Quantum Computer Science	3	1	-	4	3
Elective–3(Any one of the following)							
7	MCSE402A	Automata&Natural LanguageProcessing	3	1	-	4	3
8	MCSE402B	Cryptography and Blockchain	3	1	-	4	3
9	MCSE402C	SocialNetworkAnalysis	3	1	-	4	3
10	MCSE402D	Bioinformatics	3	1	-	4	3
11	MCSE402E	Distributed Computing	3	1	-	4	3
TotalofTheory						**12**	**9**
B.PRACTICAL (Practical Lab-4)							
12	MCS491	Dissertation	-	-	15	15	6
13	MCS493	Artificial and deep Neural network Lab			2	2	2
14	MCS494	VivaVoce	-	-	-	-	4
TotalofPractical						**17**	**12**
TotalofSemester						**29**	**21**

ElectiveTheoryPapersforSemestersIII&IV

Elective Set	CourseCode	Topic
1	MCSE301A	EmbeddedSystems
	MCSE301B	ImageProcessing
	MCSE301C	Data Compression
	MCSE301D	Python
2	MCSE401A	CloudComputing
	MCSE401B	MobileComputing
	MCSE401C	NetworkSecurity
	MCSE401D	Basic Graph Theory
	MCSE401E	Quantum Computer Science
3	MCSE402A	Automata&Natural LanguageProcessing
	MCSE402B	Cryptography and Blockchain
	MCSE402C	SocialNetworkAnalysis
	MCSE402D	Bioinformatics
	MCSE402E	Distributed Computing

First Semester

Programming in C++ (MCS101)

Introduction: How C++ differs from C, Variables Declaration, Function overloading, Optional Parameters, ReferenceVariables, Operatoroverloading, Basics of Console Input and Output Constant Pointers. Dynamic Memory Allocation

Concepts: Overview of OOPs Principles, Introduction to classes &objects Creation& destruction of objects DataMembers, MemberFunctions, thisPointer, Constructor&Destructor, Static class member, Friend class and functions, Namespace.

Inheritance and Polymorphism: Introduction and benefits, Access Specifier, Base and Derived class Constructors, Types of Inheritance, Down casting and up casting, Functionoverriding, Virtualfunctions, Destructor overriding, what is Polymorphism Pure virtual functions Virtual Base Class

I/O Streams and C++ Class Hierarchy File Stream, Text File Handling, Binary File Handling. Error handling during file operations, Overloading<< and >> operators,

Exception Handling and Templates: Introduction to Exception, Benefits of Exception handling. Try and catch block, Throw statement, pre-defined exceptions in C++. Writing custom Exception class. Stack Unwinding. Function and class templates

Text & References:

1. C++ Primer 5th Edition, Stanley Lippman,5th edition,Addison-Wesley
2. C++ Pocket Reference, 1st Edition,KyleLoudon,O'Reilly
3. C++ in One Hour a Day, Sams Teach Yourself 8th Edition,Siddhartha Rao,8th edition,Sams Publishing
4. C++ All-in-One For Dummies, 3rd Edition,Jeffrey M. Cogswell,For Dummies
5. C++: The Complete Reference, Herbert Schildt,4th edition, McGraw Hill Education

AdvancedDBMS(MCS102)

Overview of Database Management, Conceptual Database Design, Logical Database Design,Physical Database Design

Introduction to Relational Database : Relation, Optimization, The Catalog, Base Relvars and Views, Transactions, The Suppliers and Parts Database.

Relational Model Concepts, Relational Model, Constraining, Referential Integrity Constraints, Defining Referential Integrity Constraints, Update Operations on Relations, Structured Query Language (SQL), Data Definition Language Commands, Data Manipulation Language Commands, Transaction Control Commands, SQL Command Syntax and Usage, The Basic Query Block, Querying Data with Multiple Conditions, Basic Relational Algebra Operations, The Select Operation, Additional Relational Operations.

ER- and EER-to-Relational Mapping: ER- to Relational Mapping Algorithm, Summary of Mapping for Model Constructs and Constraints Mapping EER Model Concepts to Relations, Query, Processing and Optimization: Query Processing, Query Optimization, Database Tuning.

Object Oriented Database Systems: Characteristics of an Object-relation Database Management System (ORDBMS), Complex Objects, Inheritance, Function Overloading, Rules.

Distributed Database : Distributed Database System, Distributed Database Design, Data Fragmentation, Data Replication, Data Allocation, Query Processing in Distributed Databases.

Recovery : Transactions, Transaction Recovery, System Recovery, Media Recovery, Two-phase Commit.

Database Security : Security and Integrity Threats Intentional or Malicious Threats Defense Mechanisms, Security Policies, Authorization, Objects, View as objects, Granularity, Subject, Access Types.

Database Operating Systems : Features of a Database as Concurrency Control, A Concurrency Control Model Theory of Serializability Concurrency Control Algorithms, Concurrency Control Based on Timestamp Ordering Multiversion Concurrency Control Techniques, Optimistic Algorithm.

Multimedia Databases : Multimedia Data Formats, Continuous - Media Data, Similarity - Based Retrieval, Mobility and Personal Database, Database Technologies, Serving Database on the Web, Applying Databases to the Internet.

TextBooks:

1. Database System Concepts – 6th Edition by Silberschatz, Korth and Sudarshan
2. Fundamentals of Database Systems – 5th Edition by R.Elmasri, S. Navathe
3. Database Design and Relational Theory: Normal Forms and All That Jazz by C.J. Date

InformationSystems&SoftwareEngineering(MCS103)

IntroductionandISinGlobalBusinessToday.GlobalE-Business:HowBusinessUseInformationSystem,ITInfrastructureandEmergingTechnologies,FoundationsofBusinessIntelligence,Telecommunications,theinternet,andwirelessTechnology,SecuringInformationSystems,EnterpriseApplications,KnowledgeManagement,
EnhancingDecisionMaking
informationgathering,requirementandfeasibilityanalysis, data flow diagrams,process specifications, input/output design, process life cycle, software planning andmanaging the project (single & multi variable model), design, software modularity &metrics,coding,testing,implementation,maintenance,softwarequalityandreliability

TextBooks:

1. ManagementInformationSystems:ManagingtheDigitalFirm-11thEditionbyKenneth C.LaudonKennethC.Laudon
2. SoftwareEngineering:APractitioner'sApproach,7/ebyRogerSPressman,R.S.Pressman&Associates,Inc.
3. AnIntegratedApproachtoSoftwareEngineeringbyP.jalote,Springer

DiscreteMathematics&NumericalMethods(MCS104)

Propositionallogic,Logicalequivalence,Permutationandcombinations,Generatingfunctions,Recurrencerelations,GraphTheoryConceptsGraphs,sub-graphs,cyclicgraphs, Trees, spanning trees, binary trees, Algorithms- Kruskal's , Prim's , Dijkstra's ,Flyod's,Warshall's,DFS,BFS,Isomorphism,homomorphism
Finiteautomata–
NFA,DFA,Conversion,MealyM/C,MooreM/C,IntroductiontoLanguages&Grammarsandtheirrelationwith hAutomata.
Interpolation-
NewtonsForward,Backward,Sterling&Bessel'sInterpolationformula,Lagrange'sInterpolation
Integration-Trapezoidal,Simpson's1/3rd,Weddel'sRule,RombergIntegration,Gauss-Legendretwo&threepointformula,NewtonCotesFormula.
Gram-Schmidtorthogonalisation,Tchebycheffpolynomial
Solutionoftranscendentalequations-MethodofIteration,MethodofBisection,Newton -RaphsonMethod,Regula-Falsimethod,SecantMethod.
Solutionofsystemoflinearequations-GaussEliminationMethod,Gauss-Jacobi, Gauss-Seidel,LUfactorisation,Tri-diagonalisation.InverseInterpolation.LeastSquareCurvefitting-linear&non-linear
SolutionofDifferentialEquations-Picard'smethod,Euler-modifiedmethod,Taylor'sSeriesmethod,Runge-Kuttamethod,Milne'sPredictor-Correctormethod

TextBooks:

1. TheoryofComputerScience,Mishra&Chandrasekharan,PHI
2. DiscreteMathematicsforComp.Scientists&Mathematicians,Mott,Kandel&Baker,PHI
3. DiscreteMathematicalStructure,C.L.Liu,TMH
4. DiscreteMathematicalStructure,G.S.RAO
5. NumericalAnalysis,Shastri,PHI
6. NumericalMethodsforMathematics,Science&Engg.,Mathews,PHI
7. NumericalAnalysis&Algorithms,PradeepNiyogi,TMH

AdvancedComputerArchitecture(MCS105)

Basic structure of Computer, Overview of von Neumann architecture, Number systems,Boolean postulates and laws, De-Morgan's Theorem, Boolean function, Minimization ofBooleanexpressions,SOP,POS,Karnaughmap,LogicGates,CombinationalandSequentialcircuits.Overv iewonArithmeticUnit,ProcessingUnit.

MemoryDevices–RAM,ROM,Cachememory,Virtualmemory,SecondaryStorage

IOOrganization-

AccessingI/Odevices,Interrupts,DirectMemoryAccess,Buses,Interfacecircuits,StandardI/OInterfaces-PCI,SCSI,USB

Basic Parallel Processing Architecture, Taxonomy- SISD. MISD, SIMD, MIMD structures,Serial,Parallel&ConcurrentComputation,CISCVsRISC

Conceptsofpipelining,HierarchicalMemoryTechnology:Inclusion,Coherenceandlocalityproperties

Concepts of instruction-level parallelism (ILP), Superscalar, superpipelined and VLIWprocessorarchitectures;Vector andsymbolicprocessors

MultiprocessorArchitecture,Taxonomyofparallelarchitectures;Centralizedshared-memoryarchitecture,synchronization,memoryconsistency,interconnectionnetworks, Distributedshared-memoryarchitecture,Clustercomputers.

NonvonNeumannArchitectures,DataflowComputers,Reductioncomputerarchitectures,SystolicArchitectures.

TextBooks:

1. DigitalDesign,3.editionbyM.MorrisMano,PHIpublication
2. ComputerOrganizationandArchitecture–DesigningforPerformance,6thEditionbyWilliamStallings
3. AdvancedComputerArchitecture:Parallelism,ScalabilityandProgrammabilitybyKaiHwang

AdvancedOperatingSystem(MCS106)

OSservicesandcomponents,Linux File system. I/O Systems: Application I/O Interface, Kernel I/O Subsystem, multitasking,multiprogramming,timesharing,buffering,spooling

Process&threadmanagement,contextswitching,multithreading

Concurrencycontrol,mutualexclusionrequirements,semaphores,monitors, Deadlocks-detection,recovery,avoidanceandprevention

Memorymanagement,partitioning,swapping,paging,segmentation,virtualmemory,Demandpaging,page replacementandallocationalgorithm

I/O Systems, interrupt handlers, device drivers, and device independent I/O softwareSecondary-storagestructure,filesystemmanagement

Protection& security, Implementationofaccessmatrix,EncryptionCasestudieson Linux& Windows2000

IntroductiontoDistributedSystems,ArchitecturesofDistributedSystems,communicationnetworks,Mutual ExclusioninDistributedSystems,RMI,conceptofReplication, Distributed File Systems (NFS, AFS, coda) overview, security in DistributedSystems

Multiprocessor operating systems,basic multiprocessor system architectures, overviewonDatabase Operatingsystems

RealTimeOperatingSystemandOverviewonEmbeddedSystem

TextBooks:

1. AdvancedConceptsInOperatingSystemsbyMukeshSinghalandNiranjanShivaratri
2. DistributedOperatingsystemsbyAndrews.Tanenbanm
3. OperatingSystemConcepts,5thed.bySilberschatzandGalvin

(Practical Lab-1)

Programming Lab (C++) Lab (MCS191)

Variables / types of variables, Input / output streams and validation of data, Operators - arithmetic, assignment, logical, bitwise , Conditions like if / else / switch, Arrays / , multidimensional arrays, Loops - for / while / do-while, Functions, overloading functions, passing variables to functions etc.
Structures, References, Pointers, Dynamic Allocation Memory, Creating project in IDE, Classes
Object Oriented Programming, Class And Function Templates, Namespaces, Exceptions

TextBooks:

1. C++ Primer 5th Edition, Stanley Lippman,5th edition,Addison-Wesley
2. C++ Pocket Reference, 1st Edition,KyleLoudon,O'Reilly
3. C++ in One Hour a Day, Sams Teach Yourself 8th Edition,Siddhartha Rao,8th edition, Sams Publishing
4. C++ All-in-One For Dummies, 3rd Edition,Jeffrey M. Cogswell,For Dummies
5. C++: The Complete Reference, Herbert Schildt,4th edition, McGraw Hill Education

AdvancedDBMSLab (MCS192)

- SQL (Structured Query Language)
- Data Definition Language (DDL): Create, Alter, and Drop commands
- Data Manipulation Language (DML): Select, Insert, Update, and Delete commands, Basic SQL queries, Integrity constraints on tables,
- Data Control Language Commands (DCL): Grant and Revoke
- Transaction Control Language Commands (TCL): Commit, Rollback, Savepoint, Autocommit
- SQL Functions
- SQL querying to do operations such as identifying nulls, special characters, blank rows/columns, and run distributions, run data summaries, merge tables, get unique counts
- SQL Joins, Aggregate functions, and GROUP BY, Nested queries and sub queries. GROUP BY CLAUSE along basic aggregations such as SUM, COUNT, AVG RANK (), ROWNUM () & DENSE_RANK. UNION and UNION ALL CASE statement
- Introduction to Advanced SQL concepts: Indexes, Sequence, Clusters, Views, Cursors and Triggers, Embedded SQL

TextBooks:

- Database System Concepts, Abraham Silberschatz, Henry F. Korth, and S. Sudarshan
- An Introduction to Database Systems, C J Date Fundamentals of Databases – Elmasri and Navathe.
- Database Management Systems – Raghu Ramakrishna, Johannes Gehrke

OSLab(Unix)(MCS392)

Introduction; Concepts; Layers of UNIX; Role of System Administrator and Ordinary User; Tree Structure of UNIX; Root File System; /bin Directory; /dev Directory; /bin Directory; /etc Directory; /lib Directory; /proc Directory; /mnt Directory; /root Directory; /sbin Directory; /tmp Directory; /var Directory; Relative Path; Absolute Path; Creation of Directory; Creating file; removing file; Listing Files and Directories copying file; renaming file; Changing File Permission; Changing Directory Permission; Changing Group; Changing Owner; Pipe; Filters; pwd command; date command; head command; tail command less command; more command; grep command; VI Editor (Creating a new File; Inserting Text in File; Deleting Text in File; Copy , Cut & Paste Text; Save File). TCP/IP networking commands.

The administrator privileges, maintaining security, user and group management, startup and shut down, Disk related commands, Backup and recovery, password aging, advanced administration commands.

ShellProgramming-creatingascript,makingascript executable, shell syntax(variables,conditions,controlstructures,functions,commands).Process-startingaprocess, conditions, control structures, functions, commands),waiting for a process,zombie processSemaphore-programmingwith Semaphore.

Second Semester

ObjectOrientedAnalysis&Design(MCS201)

AnOverviewofObjectOrientedSystemsDevelopment,ObjectOrientedSystemsDevelopmentLifeCycle.ObjectOrientedmethodologies,RumbaughMethodology -BoochMethodology-JacobsonMethodology,UML,ObjectOrientedAnalysis&Design, softwareQualityandUsability,CaseStudies

Introduction: Origin of JAVA, features of JAVA, JAVA Environment, Hardware and Software Requirements, Byte Code , Installing JDK,Difference between C++ and JAVA, Environment Variables, System Utilities, Command-Line I/O Objects, PATH and CLASSPATH, JAVA program structure ,Variables, Primitive Data Types, Identifiers, Literals, Operators, Expressions, Precedence Rules and Associativity, Primitive type Conversion and Casting, Flow of Control(Conditional Statements, Loops,Branching Mechanism) Command Line Arguments.

Classes and Objects: Defining a class, creating objects, methods(declaration, invocation, overloading), constructors,garbage collection, static keyword, this keyword, arrays, inheritance and its types, method overriding, super keyword, final keyword, abstract class.

Interfaces and Packages: Defining Interface, Extending and implementing interface, interface vs. abstract classes.

JAVA API packages, using system packages, naming conventions, creating packages, accessing a package, using package, adding class to a package.

Exceptions, Multithreading & I/O: Types of errors, exception handling techniques, user defined exceptions, multiple catch statements, finally statements. Multithreading, life cycle of a thread, creating new threads in 2 ways, thread priority. Streams and File I/O.

GUI and Advance Java: Applets, AWT, Client-Server architecture for web- based applications, Web Container, Servlets, JSPs

TextBooks:

1. Object-OrientedAnalysisandDesignbySarnathRamnath,BrahmaDathan,Springer
2. Object-OrientedAnalysisAndDesignWithApplications,3/EbyBooch
3. Java:TheCompleteReference7/EbyHerbertSchildt,TMH
4. Sachin Malhotra and Saurabh Chaudhary , "Programming in JAVA", Oxford University Press, ISBN : 0-19-806358
5. E-Balagurusamy, "Programming with JAVA- A Primer" Tata McGraw-Hill Publishers, ISBN 0-07-463542-5
6. Dietel and Dietel "CORE JAVA"
7. Herbert Shield " The complete reference-JAVA2" , TMH

DataStructure(MCS202)

Data structures and Algorithms: an overview: concept of data structure, choice of right data structures, types of data structures, basic terminology Algorithms, how to design and develop an algorithm: stepwise refinement, use of accumulators and counters; algorithm analysis, complexity of algorithms Big-oh notation.

Arrays, Stack, Queue, Pointers, and Linked Lists, Arrays: Searching Sorting: Introduction, One Dimensional Arrays, Operations Defined: traversal, selection, searching, insertion, deletion, and sorting. Multidimensional arrays, address calculation of a location in arrays, sparse matrix, sparse matrix representation. Pointers: Pointer variables, Pointer and arrays, array of pointers, pointers and structures, Dynamic allocation. Linked Lists: Concept of a linked list. Circular linked list, doubly linked list, operations on linked lists. Concepts of header linked lists. Applications of linked lists, linked stacks, linked Queues.

Searching and Sorting Searching: Linear search, Recursive and Non recursive binary Search., Sorting: Selection sort, Bubble sort, Insertion sort, Merge sort, Quick sort, Shell sort, Heap sort Stacks and queues: Stacks, array representation of stack, Applications of stacks. Queues, Circular queues, array representation of Queues, Deque, priority queues, Applications of Queues.

Trees and Graphs: Introduction to trees, binary trees, representation and traversal of trees, operations on binary trees, types of binary trees, threaded binary trees, B Trees, Application of trees. Introduction to graphs, terminology, 'set, linked and matrix' representation, Graph traversal techniques: BFS, DFS, operations on graphs, Minimum spanning trees, Applications of graphs.

File Handling and advanced data Structure:
Introduction to file handling, Data and Information, File concepts, File organization, files and streams, working with

files. AVL trees, Sets, list representation of sets, applications of sets, skip lists

TextBooks:

1. DataStructureusingCandC++-2ndeditionbyTanenbaum
2. FundamentalsOfDataStructuresInC++byEllisHorowitz,Sahni,DineshMehta
3. IntroductiontoAlgorithmbyThomasH.Cormen,CharlesE.LeisersonandRonald.L.Riveit,
4. TheDesignandAnalysisofComputerAlgorithmsbyAlfredV.Aho,JohnE.HopcroftandJeffreyD.Ullman.
5. Data Structures using C by A. M. Tenenbaum, Langsam, Moshe J. Augentem, PHI Pub.
6. Data Structures using C by A. K. Sharma, Pearson
7. Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low Priced Edition.
8. Fundamentals of Data structures by Ellis Horowitz &SartajSahni, Pub, 1983,AW
9. Fundamentals of computer algorithms by HorowitzSahni and Rajasekaran.
10. Data Structures and Program Design in C By Robert Kruse, PHI,
11. Theory & Problems of Data Structures by Jr. SymourLipschetz, Schaum's outline by TMH
12. Introduction to Computers Science -An algorithms approach , Jean Paul Tremblay, Richard B. Bunt, 2002, T.M.H.
13. Data Structure and the Standard Template library – Willam J. Collins, 20

Design and Analysis of Algorithms (MCS203)

Introduction Brief Review of stacks, queues, graphs, binary search tree, set and disjoints set union, general sorting algorithms, Analysis of algorithms in terms of space and time complexity.

Divide and Conquer: General method, binary search, ternary search algorithm, merge sort, quick sort, selection, strassen's matrix multiplication, analysis of algorithms for these problems.

Greedy Method: General method, knapsack problem, job sequencing with deadlines, minimum spanning trees, single source paths, optimal storage on tapes, optimal merge patterns and analysis of these problems. Dynamic Programming: General method, single source shortest path, all pair shortest path, optimal binary search trees, 0/1 knapsack, the traveling salesman problem.

Back Tracking: General method, 8-queen's problem, graph coloring, sum of subsets, Hamiltonian cycles, analysis of these problems. Branch and Bound: General Method, 0/1 knapsack and traveling salesman problem.

NP-Hard and NP-Completeness: P, NP, NP-Hard, NP-Complete, Cook's Theorem and Problem Solving.

Text Books:

- Fundamental of Computer algorithms, Ellis Horowitz and SartajSahni, 1978, Galgotia Publ.,
- Introduction to Algorithms, Thomas H Cormen, Charles E Leiserson and Ronald L Rivest: 1990, TMH.
- The Design and Analysis of Computer Algorithm, Aho A.V. Hopcroft J.E., 1974, Addison Wesley.
- Algorithms-The Construction, Proof and Analysis of Programs, Berlion, P.Bizard, P., 1986.
- Johan Wiley & Sons,
- Writing Efficient Programs, Bentley, J.L., PHI

Introduction to Design and Analysis of Algorithm, Goodman, S.E. &Hedetnieni, 1997, MGH

DataCommunication&Networking(MCS204)

Fundamentalsofdatatransmission,wiredandwirelessmedia,digitalandanalogtransmission, data coding techniques, multiplexing, overview on OSI layers and TCP/IPmodel
LocalAreaNetworksanddatalinkprotocols,point-to-pointlinksandslidingwindowflowcontrol,CSMA/CD,Ethernet,wirelessLAN,cellularnetworks,andadvanced multi-usercommunication (CDMA,SDMA/MIMO),mobility
InternetworkingusingTCP/IP:networkprogrammingusingsocketAPI,networkclient/serverdesign
Packet/circuit switching and wide-area networks: store-and-forward networks, sourcerouting, virtual/permanent, circuits and call set-up, LAN/WAN addressing, hop-by-hopvs.end-to-endcontrol
Routingtechniques-intra-domainrouting(OSPF,RIP),inter-domainpolicyrouting(BGP)andnetworkconnectivity
Transport protocols - TCP and UDP, Congestion control, TCP window control, multimediastreaming
High-levelnetworkservices-DNS,HTTP,SMTP,networkmanagement(SNMP),networksecurity, Security Requirement and attacks, Cryptography: Symmetric Key (DES, AES), Public Key Cryptography (RSA), Firewall.

TextBooks:

1. ComputerNetworksbyASTanenbaum, FourthEdition,2002,PearsonEducation
2. DataCommunicationandNetworkingbyB.Forouzan
3. DataandCommunicationbyW.Stallings,
4. A.S. Tanebaum : Computer Networks (4th ed.), Prentice-Hall of India.
5. W. Tomasi : Introduction to Data Communications and Networking, Pearson, Education.
6. P.C. Gupta : Data Communications and Computer Networks, Prentice-Hall of India.
7. Behrouz Forouzan and S.C., Fegan : Data Communications and Networking, McGraw Hill.
8. L.L. Peterson and B.S. Davie : Computer Networks : A system Approach, Morgan Kaufmann.
9. William Stalilngs : Data and Computer Communications,Pearson Education.

Compiler Design (MCS205)

Assembly language fundamentals, Assemblers- One pass and Two pass. Macro, Macro Processors- Macro definition and expansion. Macro processor algorithm, Macro processor Design options. Loading, Linking, Relocation, Program relocatability, Linkage editors, Bootstrap compilers.

Compilers- Compiler structure, compiler construction tools, Phases of compiler, Finite Automata, Push Down Automata (PDA), Non-determinism and NFA, DPDA and PDAs and languages accepted by these structures. Grammars, Languages-Types of grammars. The relationship between types of grammars, and finite machines. Push Down Automata (PDA) and Context free grammars (CFG). Lexical analysis: Specification and recognition of tokens, regular expressions and regular languages. LEX package on Unix. Conversion of NFA to DFA. Minimizing the number of states to DFA.

Context free grammars (CFG): Parsing and parse trees. Representation of parse (derivation) trees as rightmost and leftmost derivations. Top-down parsers-left recursion and its removal, Recursive descent parser and predictive parser. Bottom up parsers-shift reduce, operator precedence parsing, LR parsers. YACC package on Unix system. Intermediate Codes-Quadruples, triples. Intermediate code generation, Code generation, Code Optimization-optimization.

Computer Graphics(MCS206)

An Introduction to Graphics System: What is computer Graphics? Computer Graphics and Its Types, Application of computer graphics, Graphics Systems : Video Display Devices, Raster Scan Systems, Random Scan Systems, Graphics Monitors and Workstations, Input Devices, Hard Copy Devices, Graphics Software.

Output Primitives and Attributes of Output Primitive:
Output Primitive Points and Lines, Line Drawing Algorithms, Circle Generating Algorithms, Scan-Line Polygon Fill Algorithm, Inside-Outside tests, Boundary-Fill Algorithm, Flood Fill Algorithm, Cell Array, Character Generation, Attributes of Output Primitives: Line Attributes, Color and Grayscale Levels, Area fill Attributes, Character Attributes, Bundled Attributes, Ant aliasing.

Two-dimensional Geometric Transformations:
Basic Transformations, Matrix Representation and Homogeneous Coordinates, Composite Transformations, Reflection and Shearing. Two-Dimension Viewing: The viewing Pipeline, Window to view port coordinate transformation, Clipping Operations, Point Clipping, Line Clipping, Polygon Clipping, Text Clipping, Exterior Clipping Three-Dimensional Concepts : Three Dimensional Display Methods, 3D Transformations, Parallel Projection and Perspective Projection.

Three-dimensional graphics:
Need for 3-Dimensional Imaging, Techniques for 3-Dimesional displaying, Parallel Projections, Perspective projection, Intensity cues, Stereoscope effect, Kinetic depth effect, Shading.

Multimedia:
Introduction to Multimedia: Classification of Multimedia, Multimedia Software, Components of Multimedia – Audio : Analog to Digital conversion, sound card fundamentals, Audio play backing and recording Video, Text : Hypertext, Hyper media and Hyper Graphics, Graphics and Animation : Classification of Animation. Authoring Process and Tools. Case Study: A graphics software MatLab, Use of MatLab in graphics application, Features of MatLab, generalize application by using MatLab.

Graphic devices
Cathode Ray Tube, Quality of Phosphors, CRTs for Color Display, Beam Penetration CRT, The Shadow - Mask CRT, Direct View Storage Tube, Tablets, The light Pen, Three Dimensional Devices

Text & References:

1. Donald Hearn and M. Pauline Baker : Computer Graphics, PHI Publications.
2. Plastock : Theory & Problem of Computer Gaphics, Schaum Series.
3. Foley & Van Dam : Fundamentals of Interactive Computer Graphics, Addison-Wesley.
4. Newman : Principles of Interactive Computer Graphics, McGraw Hill.
5. Tosijasu, L.K. : Computer Graphics, Springer-Verleg.
6. S. Gokul : Multimedia Magic, BPB Publication.
7. Bufford : Multimedia Systems, Addison Wesley.
8. Jeffcoate : Multimedia in Practice, Prectice-Hall.

(Practical Lab-2)

Object Oriented Programming Java Lab (MCS291)

Java Classes, Installation, Data types, variable, arrays, expressions, operators, and control structures, Objects and classes, Abstract classes, Static classes, Inner classes, Packages, Wrapper classes, Interfaces, Access control

Exception handling and IO package, Exception as objects, Exception hierarchy, Try catch, finally Throw, throws, Input streams, Output streams, Object serialization, Deserialization, Sample programs on IO files, Filter and pipe streams

Multi-threading and GUI, Thread Life cycle, Multithreading advantages and issues, Simple thread program, Thread synchronisation, Introduction to AWT programming Layout and component managers Event handling, Applet class, Applet life cycle, Passing parameters embedding in HTML, Swing components – JApplet, JButton, JFrame, etc. Sample swing programs

Database Connectivity, JDBC architecture, establishing connectivity and working with connection interface Working with statements, Creating, and executing SQL statements, J2EEoverview,Servlet &JSP.

DataStructureLab(MCS292)

Implementation of list, stack, queue, hashing,two dimensional array, Tree structures:binary trees, AVL trees, Red-Black trees, priority queues, Tree traversal algorithms,Graphsandalgorithms:Prim'salgorithm,Kruskal'salgorithm,Dijkstra'smethod,Backtracking minimumspanningtrees,Sorting&Searchingalgorithms(usingC)

Microprocessorand Micro Controller Lab(MCS293)

1. Studyof8086microprocessorkit
2. Writeaprogramusing8086fordivisionofadefineddoubleword(storedinadatasegment)byanother doubleWorddivisionandverify.
3. Writeaprogramusing8086forfindingthesquarerootofagivennumberandverify
4. Writeaprogramusing8086forcopying12bytesofdatafromsourcetodestinationandverify.
5. Writeaprogramusing8086andverifyfor:a.Findingthelargestnumberfromanarray.b.Findingthesma llestnumberfroman array.
6. Writeaprogramusing8086forarranginganarrayofnumbersindescendingorderandverify.
7. Writeaprogramusing8086forarranginganarrayofnumbersinascendingorderandverify.
8. Writeaprogramforfindingsquareofanumberusinglook-uptableandverify.
9. Writeaprogramtointerfaceatwodigitnumberusingseven-segmentLEDs.Use8085/8086microprocessorand8255PPI.
10. Writeaprogramtocontroltheoperationofsteppermotorusing8085/8086microprocessorand 8255PPI.

Microcontroller LAB Manual ProgramsPrograms Using 8051 Microcontroller

1. To Find the Largest/Smallest Element in an Array Using 8051 Microcontroller
2. To Arrange N 8-Bit Numbers in Ascending Order Using 8051 Microcontroller
3. Write an Assembly Language Program to Perform Arithmetic Operations of 8 Bit Addition/Subtraction Using 8051 Microcontroller
4. To write an assembly language program to find the square root of a given data Using 8051 Microcontroller
5. To write an assembly language program Transmitting and Receiving the data between two kits Using 8051 Microcontrollers
6. To write an assembly language program to display characters on a seven display interface Using 8051 Microcontroller
7. Write a Program to Realize a Binary UP Counter Using 8051 Microcontroller
8. To Demonstrate Conditional Bit Jump, Conditional Byte Jump, Unconditional Jump, Call and Return Instructions Using 8051 Microcontroller
9. Write an assembly language program to convert a HEX to its equivalent ASCII code and display the result in the address field.

OperationsResearch(MCS301)

Introduction to OR, Quantitative approach to management decision making, Analyzingand defining the problem, Developing a model, Selecting the inputs and putting themodeltowork,TypicalapplicationsofOR.
Linear Programming, Formulatingmaximization/minimizationproblems,Graphicalsolution, simplexmethods,SpecialcasesofLP,DualityofLP andits interpretation,Dualsimplexmethods,PostOptimality/sensitivityanalysis,ApplicationsofLP.Transportation andAssignmentproblems,VAMmethod,checkingforoptimallyusingMODI method, Unbalancedproblemanddegeneracy,Hungarianmethodforassignmentproblem,travelingsalesmanproblem .
Gametheory-
2Personzerosumgames,Saddlepoint,Mixesstrategiesuseofdominancerules,Solutionbygraphical methods.
Simulation Modeling - Monte Carlo simulation, Using random numbers, Applications ininventoryanalysis.
Replacement models - Types of replacement problems, Replacement of assets thatdeteriorate with time, Markov Analysis: Brand switching analysis, Prediction of marketsharesfor future periods, Equilibrium conditions,UsesofMarkov analysis.
PERT,CPM,NetworkAnalysis,CriticalPath,DeterminationofFloat

TextBooks:

1. OperationsResearchbyARavindran,DonTPhilipsandJamesJSolberg.
2. OperationsResearchbyHamdyATaha

Software Engineering (MCS302)

Introduction to Software Engineering:
What is software engineering? Software engineering costs, what are the key challenges facing software engineering? Systems engineering & software Engineering, the evolving role of software, changing nature of software, software myths. A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI), process patterns, process assessment, personal and team process models. Process models: The waterfall model, incremental process models, evolutionary process models, the unified process.

Requirements, Analysis, and specification
Software Requirements engineering, Requirement engineering process, Requirement Engineering Tasks, Types of requirements, SRS.

System modelling
Data Modeling, Functional modelling and information flow: Data flow diagrams, Behavioural Modeling, The mechanics of structured analysis: Creating entity/ relationship diagram, data flow model, control flow model, the data dictionary. Process modeling with physical and logical DFDs

System Design

Design principles, the design process; Design concepts: Abstraction, refinement, modularity, software architecture, control hierarchy, structural partitioning, data structure, software procedure, information hiding; Effective modular design: Functional independence, Cohesion, Coupling; Design Heuristics for effective modularity, Data Design, Architecture Design, Interface Design

Software Testing and maintenance

Testing terminology—error, bug/defect/fault, failure, Verification and validation, Test case design, Static testing, Dynamic testing--- Black box testing—Boundary value analysis, White box testing-- basis path testing, Unit testing, Integration testing, Acceptance Testing, debugging, debugging process debugging approaches. Software maintenance categories, Models

Software Quality Models and Standards

Quality concepts, Software quality assurance, SQA activities, Formal approaches to SQA; Statistical software quality assurance; CMM, The ISO 9126 Standard

Text & References:

1. Software Engineering – A Practitioner's Approach, Roger S. Pressman, 1996, MGH.
2. Fundamentals of software Engineering,Rajib Mall, PHI
3. Software Engineering by Ian sommerville, Pearson Edu, 5th edition, 1999, AW,
4. Software Engineering – David Gustafson, 2002, T.M.H
5. Software Engineering Fundamentals Oxford University, Ali Behforooz and Frederick J. Hudson 1995
6. JW&S,
7. An Integrated Approach to software engineering by Pankaj jalote , 1991 Narosa,
8. Software Testing: Principles and Practices, Dr. Naresh Chauhan.

Soft Computing(MCS303)

Module 1: Introduction to Soft Computing

Concept of computing systems., soft vs hard computing hard computing, Characteristics of Soft computing, Applications of Soft computing techniques

Module 2: Fuzzy logic

Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification.

Module 3: Genetic Algorithm:

History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization.

Module 4: Neural Networks:

What is Neural Network, Learning rules and various activation functions, Single layer Perceptron, Back Propagation networks, Architecture of Backpropagation (BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing

Map, Recent Applications.

Module 5: Backpropagation Networks
GA based Backpropagation Networks (GA based Weight Determination, K - factor determination in Columns), Fuzzy Backpropagation Networks (LR type Fuzzy numbers, Fuzzy Neuron, Fuzzy BP Architecture, Learning in Fuzzy BP, Application of Fuzzy BP Networks)

TextBooks:

1. IntroductiontoArtificialIntelligenceandExpertSystemsbyD.W.Patterson
2. ArtificialIntelligence:AModernApproach-3rdeditionbyStuartRussell&PeterNorvig
3. ArtificialintelligencebyElaineRich&KevinKnight
4. PrinciplesofArtificialIntelligencebyJ.Nilsson,NarosaPublishingHouse
5. S. Rajasekaran and G. A VijayalakshmiPai: Neural Network, Fuzzy Logic and Genetic
6. Algorithm(Synthesis and Applications) PHI
7. M. Mitchell: An Introduction to Genetic Algorithms, Prentice-Hall India.
8. J.S.R. Jang, C.T. Sun and E.Mizutani: Neuro-Fuzzy and Soft Computing, PHI, Pearson Education.
9. M. Ganesh: introduction to Fuzzy Sets and Fuzzy Logic, PHI.
10. Timothy J. Ross: Fuzzy Logic with Engineering Applications, McGraw-Hill.
11. D.E. Goldberg : Genetic Algorithms in Search, Optimization, and Machine Learning,
12. Addison-Wesley.
13. Z. Michalewicz: Genetic Algorithms + Data Structures = Evolution Programs, Spinger-Verlag.
14. N.K. Sinha & M.M. Gupta (Eds): Soft Computing & intelligent Systems: Theory & Applications, Academic Press.

Data Mining and warehousing (MCS304)

Introduction to Data Mining. Different kinds of data and patterns that are mined. Technologies used. Applications, Major Issues. Data Objects and Attribute Types, Basic tatistical Description of Data, Data visualisation, Measuring Data Similarity and dissimilarity, Data Pre-processing, Data cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization.

Data mining algorithms: Association Rule Mining, Classification and Prediction: -Issues Regarding Classification and Prediction, Classification by Decision Tree. Introduction, Bayesian Classification, Rule Based Classification, Classification by Back propagation, Support Vector Machine , Associative Classification , Lazy Learners , Other Classification Methods

Basic concepts of Data Warehousing. Data warehousing modelling: Data cube and OLAP –Data warehouse design and usage. Data Warehouse Design and usage. Data warehouse Implementation. Data cube Technology. Classification, Decision Tree Induction, Bayes classification, Rule based classification, classification by back propagation.

Types of Data in Cluster Analysis, Model-Based Clustering Methods, Hierarchical and Partitioning methods. Outlier–Outlier detection techniques. Data mining Applications, Data mining and society. Data mining Trends, Data

mining software.

Advanced Techniques, Web Mining, Text mining, Spatial and Temporal Mining. Sequential Pattern Mining Mining Spatiotemporal and Trajectory Patterns, Multivariate Time Series (MVTS) Mining

Text & References:

- J Han, M Kember, J Pei, Morgan Kaufman, "Data Mining : Concepts and Techniques" , 3rd ed.,
- Alex Berson,Stephen J. Smith, "Data Warehousing, Data Mining, & OLAP", Tata McgrawHill, 2004.
- Berry Micheal and Gordon Linoff, Mastering Data Mining. John Wiley & Sons Inc.
- Witten, E. Frank, M. Hall. "Data Mining: Practical Machine Learning Tools and Techniques", Morgan Kaufmann Publishers, 2011.

Visual and Dot Net (.NET) (MCS305)

Introduction: The origin of .NET, Basics of .Net Framework & its Key design goals, 3-tier architecture, managed code, assemblies, CLR, Execution of assemblies code, IL, JIT, .NET framework class library, common type system, common language specification, metadata; Interoperability with unmanaged code, Net Framework Base Classes : System Namespaces; the System Types; System. Object class; System.Exception Class; System.Collections;

Development Environment: Projects & Solutions, User Interface Elements, The Visual Studio Start Page; Visual Studio.Net work area; Navigational Features, Understanding Window Forms; Viewing and changing properties; Adding controls to the form.

Data Types in C# and user interface

Data Types C#: Data Types, Operators, Methods, Handling Strings, Jagged Array, Array list, Indexer (one Dimension) and property, Interfaces, Delegates, and events. User Interface: Procedures in VB.NET, Garbage Collection, Message boxes; Dialog boxes; Menus and Toolbars; creating menu; adding Toolbars and buttons; defining an icon for a toolbar button; Adding Functionality to the Toolbar; Exception Handling.

ADO.Net

Architecture of ADO.Net, Comparison with ADO, ADO.Net Object Model, Net Data provider, Data Adapter, Data Set, Data Row, Data Column, Data Relation, command, Data Reader, Connecting to Database, Accessing & Manipulating Data and Performing Data Updates.

ASP. Net

Anatomy of ASP .NET Page, ASP.Net Features, Introduction to Web Forms Server Controls : label, dropdown list box, Button, AdRotator , Textbox, Checkbox etc. , Validation controls, ASP.NET Web Services, State Management ,Caching, Authentication (window,.Net Passport, Forms Based), Securing ASP.NET Applications

Text & References:

1. Jeffrey Richter, Francesco Balena: Applied .Net Framework
2. Prog. In MS VB. Net, TMH Publications.
3. Herbert Schildt : Complete Reference C#, TMH Publication.
4. Michael Halvorsan : Microsoft Visual Basic.NET step by step,PHI Publication.
5. Balaguruswamy: Programming in C#, TMH Publications
6. Rebecca M.Riordan: Microsoft ADO.NET Step By Step , PHI Publication

Data Science and big data tools(MCS306)

Introduction

Introduction to Data Science, Key components in Data Science , Use cases from different application domains such as Banking, Retail, Telecom, Life Science and Healthcare, etc, Challenges involved in Data Science, Ethics in Data Science

Big Data and its Importance,

Big data introduction, Structured, Semi-structured and Unstructured data, V's of Big Data, Drivers for Big Data, Introduction to Big Data Analytics, Big Data Analytics applications.

Big data technologies

Bigdata technologies, distributed data processing, bigdata processing requirements, Hadoop, Components of Hadoop – The Hadoop Distributed File System, Hadoop MapReduce and Hadoop Common Components. Application Development in Hadoop – Pig, Hive. HBase. Getting Your Data into Hadoop – Basic Copy Data,. NoSQL, CAP theorem.

Integration of data warehousing and bigdata

Integration of data warehousing and bigdata, components of the new data warehouse, bigdata appliances, Data Discovery and Visualization: bigdata analaytics, business problems suited for bigdata analytics, metadata, processing complexity of bigdata, Big Sheets. Advanced Text Analytics Toolkit. Machine learning Analytics, graph analytics.

Text & References:

- An Introduction to Data Science, Jeffrey Stanton, Syracuse University
- A Simple Introduction to DATA SCIENCE, Lars Nielsen, Noreen Burlingame
- Introduction to Data Science, DAN POTTER,CARSTEN BINNING,ELI UPFAL
- Big Data and Analytics, Seema Acharya , Subhashini Chellappan
- Professional Hadoop Solution, Boris Lublinsky, Kevin T. Smith, Alexey Yakubovich

ElectiveTheorypapers-1

EmbeddedSystems(MCSE301A)

IntroductiontoEmbeddedSystems:Definitionof Embedded System, EmbeddedSystemsVsGeneralComputingSystems,HistoryofEmbeddedSystems,Classificationof Embedded Systems, Relation between Microcontroller and Embedded System, MajorApplicationAreas,PurposeofEmbeddedSystems, Characteristics and QualityAttributesofEmbeddedSystems

Embeddedprocessors:TypesofEmbedded Processors, Microprocessors,Microcontrollers, DSP, Embedded Processors from Future Electronics, Applications forembeddedprocessors,ChoosingtheRightEmbeddedProcessor.

Embedded Systems- Application- and Domain- Specific: Washing Machine-ApplicationSpecificExampleofEmbeddedSystem,Automotive-DomainSpecificExampleofEmbeddedSystem.

CoreoftheEmbeddedSystem:GeneralPurpose and Domain Specific Processors,ASICs,PLDs,CommercialOff-The-ShelfComponents(COTS),

EmbeddedMemories:ScratchpadMemories,CacheMemories,FlashMemories,Memory according to the type of Interface, Memory Shadowing, Memory selection forEmbeddedSystems,SensorsandActuators.

CommunicationInterface:OnboardandExternalCommunicationInterfaces.

Embedded Firmware: Reset Circuit, Brown-out Protection Circuit, Oscillator Unit,

RealTimeClock,WatchdogTimer,EmbeddedFirmware Design Approaches andDevelopmentLanguages.
RTOS Based Embedded System Design: Operating System Basics, Types of OperatingSystems,Tasks,ProcessandThreads,MultiprocessingandMultitasking,TaskScheduling.
TaskCommunication:SharedMemory,MessagePassing,RemoteProcedureCalland
Sockets,TaskSynchronization:TaskCommunication/SynchronizationIssues,TaskSynchronizationTechniques,DeviceDrivers,Howto ChooseanRTOS.
TrendsinEmbeddedIndustry:ProcessorTrendsinEmbeddedSystem,EmbeddedOSTrends,DevelopmentLanguageTrends

TextBooks:

1. IntroductiontoEmbeddedSystems-ShibuK.V,McGrawHill.

ReferenceBooks:

1. EmbeddedSystems-RajKamal,TMH.
2. IntroductiontoEmbeddedSystems-ShibuKV,TMH
3. EmbeddedSystemDesign-FrankVahid,TonyGivargis,JohnWiley.
4. EmbeddedSystems–Lyla,Pearson,2013
5. AnEmbeddedSoftwarePrimer-DavidE.Simon,PearsonEducation.

ImageProcessing(MCSE301B)

Introduction:Definition,OriginsofDigitalImageProcessing,Applications,FundamentalSteps,Components, Mathematical Preliminaries
DigitalImageFundamentals:ImagesensingandAcquisition,ImagesamplingandQuantization,Somebasicrelationshipsbetweenpixels,LinearandNonlinear Operations
ImageEnhancementinSpatialDomain:
BasicGrayLevelTransformation,HistogramProcessing,EnhancementusingBasicArithmeticOperations,SmoothingSpatialFilters,SharpeningSpatialFilters
ImageEnhancementinFrequencyDomain:IntroductiontoFourierTransformandandthe Frequency Domain, SmoothingFrequencyDomainFilters,Sharpening FrequencyDomain Filters, HomomorphicFiltering,Implementation
ImageRestoration:RestorationProcess,NoiseModels,RestorationintheProcessofNoiseOnly-SpatialFiltering,PeriodicNoiseReductionbyFrequencyDomainFiltering,
LinearPositionInvariantDegradations,EstimatingDegradations,InverseFiltering,Wiener Filtering, Constrained Least Square Filtering, Geometric Mean Filtering,GeometricTransformations
ColourImageProcessing:Introduction, Colour Models, Pseudo Colour Image, Processing, Basics of Full-
ColourImageProcessing,ColourTransformations,SmoothingandSharpening,ColourSegmentation,Noise,Compression
ImageCompression:Introduction, Compression Models, Elements of Information Theory, Error FreeCompression,LossyCompression,ImageCompressionStandards
ImageSegmentation:DetectionofDiscontinuity,EdgeLinkingandBoundaryDetection,Threshholding,Region BasedSegmentation, Use of Motion insegmentation
ImplementationofImageProcessingOperationsUsingMATLAB/ImageJ/SciLab:
IntroductiontoImageProcessingFunctions,Implementationof different
ImageProcessingOperations,ImplementationofgeneralHPandLPfilters,ImplementationofSpecialFilterslikeInverse,CLS,Weineretc.ColourImageProcessing

TextBooks:

1. GonzalezandWoods,DigitalImageProcessing,Pearson
2. Soloman,FundamentalsofDigitalImageProcessing,Wiley

Data Compression (MCSE301C)

Compression Techniques: Loss less compression, Lossy Compression, Measures of performance, Modeling and coding, Mathematical Preliminaries for Lossless compression: A brief introduction to information theory, Models: Physical models, Probability models, Markov models, composite source model, Coding: uniquely decodable codes, Prefix codes.

The Huffman coding algorithm: Minimum variance Huffman codes, Adaptive Huffman coding: Update procedure, Encoding procedure, Decoding procedure. Golomb codes, Rice codes, Tunstall codes, Applications of Hoffman coding: Loss less image compression, Text compression, Audio Compression.

Coding a sequence, Generating a binary code, Comparison of Binary and Huffman coding, Applications: Bi-level image compression-The JBIG standard, JBIG2, Image compression. Dictionary Techniques: Introduction, Static Dictionary: Diagram Coding, Adaptive Dictionary. TheLZ77 Approach, The LZ78 Approach, Applications: File Compression-UNIX compress, Image Compression: The Graphics Interchange Format (GIF), Compression over Modems: V.42 bits, Predictive Coding: Prediction with Partial match (ppm): The basic algorithm, The ESCAPESYMBOL, length of context, The Exclusion Principle, The Burrows-Wheeler Transform: Move to-front coding, CALIC, JPEG-LS, Multi-resolution Approaches, Facsimile Encoding.

Arithmetic Coding,Dictionary Techniques, Context-Based Compression, Lossless Image Compression, Mathematical Preliminaries for Lossy Coding, Scalar Quantization, Vector Quantization, Differential Encoding, Mathematical Preliminaries for Transforms, Subbands, and Wavelets.

Module 5:

Audio Coding, Video Compression, Analysis/Synthesis and Analysis by Synthesis Schemes.

Text & References:

1. K. Sayood, Introduction to Data Compression, Morgan-Kaufmann.
2. Hua Harry Li, Shan Sun, HalukDerinVideo Data Compression for Multimedia Computing.
3. Roy Hoffman (2012) Data Compression in Digital Systems, Springer Science & Business Media.
4. Nelson, The Data Compression Book, MGH.

Python(MCSE301D)

Introduction to Python: Overview of Python, applications, usage, and comparative study with other software.Basics of Python: Syntax, Data Types, Variables, Operators, Input/output, Flow of Control (Modules, Branching), Basic Programming with Python: If, If- else, Nested if-else, Looping, For, While, Nested loops, Control Structure, Break, Continue, Pass,

Data Structures of Python: Strings and Tuples, Accessing Strings, Basic Operations, String slices, Working with Lists, Introduction, accessing list, Operations, Function and Methods, Files, Modules, Dictionaries, Functions and Functional Programming, Declaring and calling Functions, Declare, assign and retrieve values from Lists, Introducing Tuples, Accessing tuples

Advanced Python: Object Oriented, OOPs concept, Class and object, Attributes, Inheritance, Overloading, Overriding, Data hiding, Operations Exception, Exception Handling, Except clause, Try finally clause, User Defined Exceptions, Python Libraries:Introduction to Machine learning packages like NUMPY, SCIPY, PANDAS etc.

Text & References:

- Think Python by Allen B. Downey
- Introducing Python by Bill Lubanovic
- Hello World by Warner Sande and Carter Sande
- Learning Python , 5th Edition , Mark Lutz
- Python For Data Analysis by W Mckinney

(Practical Lab-3)

ORLab(MCS391)[usingC++]

1) LinearProgramming(Tranportation,Assignment,Duality,Simplex)
2) ShortestPath(Dijkstra's,Floyd'sAlgorithm)
3) MaximalFlow.
4) QueuingTheory
5) PERT/CPM
6) IntegerProgrammingProblem(Branch&BoundProblem

Visual and Dot Net (.NET) Laboratory (MCS392)

Module 1: Introduction to C#, Variables and expressions, flow controls, functions, debugging and error handling, OOPs with C#, Defining classes and class members. Assembly, Components of Assembly, Private and Shared Assembly, Garbage Collector, JIT compiler. Namespaces

Module 2:

Collections, Comparisons and Conversions, Delegates and Events, Windows programming: Controls(Button, Label, Link Label, Radio Button, Check Box, Text Box, Rich Text Box, List Box, Checked List Box, List View, Tabbed), Forms (Menus and Tool Bars, SDI and MDI applications, Building MDI applications.

Module 3:

Introduction to ASP.NET 4: Microsoft.NET framework, ASP.NET lifecycle. Themes in ASP.NETCSS: Need of CSS, Introduction to CSS, Working with CSS with visual developer ASP.NET server controls: Types of control, ASP.NET state management engine. Web.config and global.asax files.

Module 4:

Programming ASP.NET web pages: Introduction, data types and variables, statements, organizing code, object-oriented basics. Master Pages, Caching.Navigation: Using navigation controls, programmatic redirection, User Controls: Introduction to user controls Validating User Controls

Module 5:

Databases: Introduction, Using SQL to work with database, retrieving and manipulating data with SQL, working with ADO.NET, ADO.NET architecture, ASP.NET data control, data source control, deploying the web site. Crystal reports.

LINQ: Operators, implementations, LINQ to objects, XML, ADO.NET, Query Syntax ASP.NET Security: Authentication, Authorization, Impersonation, ASP.NET provider model

Text & References:

1. Beginning Visual C# 2010, K. Watson, C. Nagel, J.H Padderson, J.D. Reid, M.Skinner, Wrox (Wiley) 2010. (Unit I and II).
   Beginning ASP.NET 4 in C# and VB, I. Spanjaars, Reprint 2011 (Unit III to VI).
2. ASP.NET 4.0 programming, J. Kanjilal, Tata McGraw-Hill (Unit III to VI).
3. Programming ASP.NET, D. Esposito, Microsoft Press (Dreamtech), Reprint 2011.
4. ASP.NET Visual C#.NET, Vijay Nicoel, TMH
5. Advanced .NET Technology, Patel, Dreamtech.

Data Science and big data tools Lab (MCS393)

Bigdata technologies, distributed data processing, bigdata processing requirements, Hadoop, Components of Hadoop – The Hadoop Distributed File System,

Hadoop MapReduce and Hadoop Common Components. Employing Hadoop Map Reduce, Creating the components of Hadoop Map Reduce jobs, Distributing data processing across server farms, Executing Hadoop Map Reduce jobs, Monitoring the progress of job flows, The Building Blocks of Hadoop Map Reduce, Distinguishing Hadoop daemons, Investigating the Hadoop Distributed File System Selecting appropriate execution modes: local, pseudo-distributed, fully distributed.

Introduction to Pig Data Flow Engine, Pig installation, Grunt shell, Loading data, Exploring Pig Latin commands, Pig Transformations functions, Joins in Pig, Hands on Exercises

Architecture of Hive, Hive Services, RDBMS, HiveQL and the Hive shell, Data types and schemas, Creating tables (external vs. managed), Creating Partitions, Creating Views, UDF function in java in Hive, Using hive to create diff types of format

Text & References:

- • Programming PiG, Wiley Publication, Alan Gates
- • Programming Hive, Wiley Publication, Jason Rutherglen, Dean Wamplor& Edward Capriolo

Fourth Semester

Artificial and deep Neural network (MCS401)

Neural Networks Overview, Neural Network Representation, Computing a Neural Network's Output, Vectorizing across multiple examples, Explanation for Vectorized Implementation, Activation functions, Why do you need non-linear activation functions?, Derivatives of activation functions, Gradient descent for Neural Networks, Backpropagation intuition, Random Initialization.

Binary Classification, Logistic Regression Cost Function, Gradient Descent, Derivatives, More Derivative Examples, Computation graph, Derivatives with a Computation Graph, Logistic Regression Gradient Descent, Gradient Descent on m Examples, Vectorization, More Vectorization Examples, Vectorizing Logistic Regression, Vectorizing Logistic Regression's Gradient Output, Explanation of logistic regression cost function

Deep L-layer neural network, Forward Propagation in a Deep Network, Building blocks of deep neural networks, Forward and Backward Propagation, Parameters vs Hyperparameters, What does this have to do with the brain?

Text & References:

- • Deep learning: adaptive computation and machine learning, Bengio, Yoshua, Courville, Aaron, Goodfellow, Ian J
- • Deep Learning: A Practitioner's Approach, J. Patterson, A. Gibson
- • Neural Networks and Deep Learning: A Textbook, Charu C. Aggarwal
- • Neural Networks and Deep Learning, Michael Nielsen.

Elective–2

CloudComputing(MCSE401A)

Introduction: Cloud computing definition, reference model, Characteristics, Benefits,Challenges,DistributedSystems,Virtualization,Service-orientedcomputing,Utility-oriented computing, Overview on computing platforms & technologies – AWS,GoogleAppEngine, MS Azure, Hadoop,Saleforce.com,ManjrasoftAneka

Parallel&DistributedComputing:Parallelvs.Distributedcomputing,Elementsofparallelcomputing,Parallel processing-hardwarearchitecture&approaches,Concept& Component of DistributedComputing, RPC, Service-oriented computing

Virtualization: Cloud reference model – IaaS, PaaS, SaaS, Types of clouds – Public,Private,Hybrid,Community,Cloudinteroperability&standards,scalability&faulttolerance,Security ,trust&privacy

ConcurrentComputing,High-throughputComputingandData-IntensiveComputing:Programming applications with Threads, Thread API, Parallel computation with Threads,Taskcomputing,FrameworksforTaskcomputing,Task-basedapplicationmodel,Data-intensivecomputing,characteristics,technology

CloudPlatformsandApplications:OverviewonAmazon Web Services, GoogleAppEngine and Microsoft Azure, Cloud applications in scientific, business and consumerdomain

TextBooks:

1. Buyya,VecciolaandSelvi,MasteringCloudComputing:FoundationsandApplicationsProgramming,TataMcGrawHill
2. RittinghouseandRansome,CloudComputing:Implementation,Management,andSecurity,CRCPress
3. AravindDoss,CloudComputing,TataMcGrawHill
4. KrisJamsa,CloudComputing:SaaS,PaaS,IaaS,Virtualization,Business Models,Mobile,SecurityandMore,Jones&BartlettLearning

MobileComputing(MCSE401B)

IntroductionandApplicationofMobileComputing,

WirelessTransmission:Frequencyforradiotransmission,Signals,Antennas,Signalpropagation,Multiplexing , Modulation,Spread spectrum,Cellularsystems

MediumAccessControl:MotivationforaspecializedMAC:HiddenandExposedterminals.NearandFartermin als;SOMA,FOMA

TOMA:FixedTOM,ClassicalAloha,SlottedAloha,Carriersense multiple access,Demandassignedmultipleaccess,PRMApacketreservationmultipleaccess, PRMApacket reservation multiple access, reservation TOMA, Multiple access with collisionavoidance,Polling,Inhibitsensemultipleaccess

CDMA:SpreadAlohamultipleaccess

TelecommunicationSystems:GSM:MobileServices,SystemArchitecture, radiointerface, Protocols, Localization and Calling, Handover, Security, New Data Services,DECT,SystemsArchitecture

ProtocolArchitecture:TETRAI,UMTSandIMT-2000,UMTSBasicArchitecture,UTRAFDDmode,UTRATDDmode

Satellite Systems: History, Applications, Basics: GEO, LEO, MEO, Routing, Localization.Handover ExamplesBroadcast Systems: Overview, Cyclic Repetition, Digital Audio; broadcasting:MultimediaobjecttransferProtocol;DigitalVideobroadcasting

Wireless LAN:Infrared vs. Radio Transmission, Infrastructure and Ad Hoc networks,IEEE802.11:SystemArchitecture,ProtocolArchitecture, Physical Layer, MediumAccessControlLayer,MACmanagement,Futuredevelopment;HIPERLAN:Protocolarchitecture, Physical Layer Channel access control. Sublayer, Medium Access controlsublayer,Information basesandnetworking;

Bluetooth:UserScenarios,PhysicalLayer,MAClayer,Networking,Security,Linkmanagement.

WirelessATM:MotivationforWATM,WirelessATMworkinggroup,WATMservices,Referencemodel:Exa mpleconfigurations,Genericreferencemodel;
Handover:Handover reference model, Handover requirements, Types of handover,Handoverscenarios,Backwardhandover,Forwardhandover;Locationmanagement:Requirement s for location management, Procedures and Entities; Addressing, Mobilequalityofservice,Accesspointcontrol protocol.
Mobile Network Layer: Mobile IP: Goals, assumptions and requirements, Entities andTerminology,IPpacketdelivery,Agentadvertisementanddiscovery,Registration,TunnelingandEncaps ulation,Optimizations,Reversetunneling,Ipv6;Dynamichostconfigurationprotocol,Adhocnetworks:Routi ng,Destination sequence distancevector,Dynamicsource routing,Hierarchicalalgorithms,Alternativemetrics.
MobileTransportLayer:TraditionalTCP:Congestioncontrol,Slowstart,Fastretransmit/fastrecovery,Implic ationsonmobility;IndirectTCP,SnoopingTCP,Mobile rcp,Fastretransmit/fastrecovery,Transmission/time-outfreezing,Selectiveretransmission,TransactionorientedTCP.
SupportforMobility:File systems: Consistency, Examples; World Wide Web: Hypertext transfer protocol,Hypertextmarkuplanguage,Someapproaches that might help wireless access,Systemarchitectures;
Wirelessapplicationprotocol:Architecture,Wirelessdatagraramprotocol,Wirelesstransportlayersecurity, Wirelesstransactionprotocol,Wirelesssessionprotocol,Wirelessapplicationenvironment,Wirelessmarkup language;WMLscript,Wirelesstelephonyapplication,Examples"StackswithWAP,Mobiledatabases,Mobi leagents, SecurityandprivacyaspectsofMobileComputing.

TextBooks:

1. JochenSchiller,MobileCommunications,2ndEdition,Pearson
2. WilliamStallings, WirelessCommunicationsandNetworks,PHI
3. Rappaport,WirelessCommunicationsPrincipalsandPractices,PHI
4. YI BingUn, Wireless and MobileNetwork Architectures,JohnWiley

NetworkSecurity(MCSE401C)

ConceptsandTerminology:Threats,Attacks,ServicesandMechanisms,SecurityAttacks, Security Services,Integritycheck,digitalSignature,authentication,Spoofing,Sniffing,Firewall.
Cryptography:Techniques,Mathematicalfoundation,StreamCiphers,BlockCiphers,Cryptanalysis,HashAl gorithms.
SecretKeyCryptography:Block Encryption, DES rounds, S-Boxes IDEA: Overview, comparison with DES, Keyexpansion, IDEA rounds, Uses of Secret key Cryptography; ECB, CBC, OFB, CFB,MultipleencryptionsDES.
HashFunctionsandMessageDigests:Lengthofhash,uses,algorithms(MD2,MD4,MD5,SHS)MD2:Algorit hm(Padding,checksum, passes.) MD4 and 5: algorithm (padding, stages, digest computation.) SHS:Overview,padding,stages.
PublickeyCryptography:Algorithms,examples,Modulararithmetic(addition,multiplication,inverse,andexp onentiation) RSA: generating keys, encryption and decryption. Other Algorithms:PKCS,Diffie-Hellman,El-Gamalsignatures,DSS,Zero-knowledgesignatures.
Authentication:PasswordBased,AddressBased, Cryptographic Authentication. Passwords indistributed systems, on-line vs offline guessing, storing. Cryptographic Authentication:passwordsaskeys, protocols,KDC'sCertificationRevocation,Inter-domain, groups,delegation.AuthenticationofPeople:Verificationtechniques,passwords,lengthofpasswords,passwor ddistribution,smartcards,biometrics.
SecurityPoliciesandSecurityHandshakePitfalls:Whatis security policy,highandlowlevelpolicy,user issues?Protocolproblems,assumptions,Sharedsecretprotocols,publickeyprotocols,mutualauthentication,re flectionattacks,useoftimestamps,nonce andsequencenumbers,sessionkeys,one-andtwo-waypublickeybasedauthentication.
Network Security:Electronicmailsecurity,IPsecurity,Network managementsecurity.
Securityforelectroniccommerce:E-commercesecurityanalysis,protocol,SSL,SETSystemSecurity:IntrudersandViruses,Firewalls,IntrusionDet

ection.
CaseStudies
Web threats, E-mail threats, Domain controller threats, Extranet and VPN threats.AssignmentandProjectwork.

TextBooks:

1. AtulKahate,CryptographyandNetworkSecurity,McGrawHill
2. Kaufman, c., Perlman, R., and Speciner, M., Network Security, PrivateCommunicationinapublicworld,2nded.,PrenticeHallPTR.,2002
3. Stallings,W.,.CryptographyandNetworkSecurity:PrinciplesandPractice,3rd ed.,PrenticeHallPTR., 2003
4. Stallings,W.Networksecurity'Essentials:Applicationsandstandards,PrenticeHall,2000
5. CryptographyandNetworkSecurity;McGrawHill;BehrouzAForouzan
6. InformationSecurityIntelligenceCryptographicPrinciplesandApp.CalabreseThomson
7. D.P.Nagpal,InformationSecurity,S.ChandComplanyLimited
8. 7.SecuringAWirelessNetworkChrisHurleySPD.

Basic Graph Theory (MCSE401D)

Fundamental concepts of graphs Basic definitions of graphs and multigraphs; adjacency matrices, isomorphism, girth, decompositions, independent, sets and cliques, graph complements, vertex coloring, chromatic number, important graph like cubes and the Petersen graph, Paths, cycles, and trails; Eulerian circuits. Vertex degrees and counting; large bipartite subgraphs, the handshake lemma, Havel-Hakimi Theorem, Directed graphs: weak connectivity, connectivity, strong, components, Induction and other fundamental proof techniques

Trees Basics: equivalent characterizations of trees, forests, Spanning trees and 2-switches, Distance and center, Optimization: Kruskal's Theorem and Dijkstra's Theorem
Matching and covering Bipartite matching, vertex cover, edge cover, independent set, M-alternating path, Hall's Theorem, König-Egeváry Theorem, Gallai's Theorem

Connectivity and Network flow Vertex cuts, separating sets, bonds; vertex and edge connectivity, block-cutpoint tree, Menger's Theorem: undirected vertex and edge versions, Ford-Fulkerson Labeling algorithm, flow integrality, Max-flow/Min-cut Theorem, proof of Menger's Theorem
Coloring and Planarity Chromatic number: lower bounds from clique number and maximum independent set, upper bounds from greedy coloring (& Welsh-Powell), Szekeres-Wilf, and Brooks' Theorem. Also k-critical graphs, cartesian product of graphs, and interval graphs, k-Chromatic graphs: Mycielski's construction, Turán's Theorem, Edge coloring, line graphs, Vizing's Theorem Embeddings, dual graphs, Euler's formula Kuratowski's Theorem, Coloring, including the 5-color theorem
Text & References:

- A Walk Through Combinatorics, Miklos Bona
- Doug West, Introduction to Graph Theory
- Alan Tucker's Applied Combinatorics
- Pearls in Graph Theory: A Comprehensive Introduction by Nora Hartsfield
- *Introduction to Graph Theory* by Richard J. Trudeau
- Graph and Digraphs, by Chartrand, Lesniak, and Zhang
- Bollobás's Modern Graph Theory
- Introduction to Graph Theory by Wilson.
- Graph Theory: Modeling, Applications, and Algorithms by GeirAgnarsson

Quantum Computer Science(MCSE401E)

Introduction: Elementary quantum mechanics:, linear algebra for quantum mechanics,Quantum states in Hilbert space,The Bloch sphere, Density operators, generalized measurements, no-cloning theorem.

Quantum gates and algorithms.
Universal set of gates, quantum circuits, Solovay-Kitaev theorem, Deutsch-Jozsa algorithm, factoring, Simon's algorithm,Period Finding Shor's Algorithm QFT (Basics), The prime factorization algorithm, Grover's search algorithm

Quantum Computation and optimization
Implement quantum programs in NISQ model of computing, Current machines (5-50 qubit) What is NISQ Model?, NISQ Metrics, Qubit Mapping Problem Qubit Allocation Problem, Become familiar with Quantum Approximate Optimization Algorithm,Maxcut problem Overview of QAOA Optimizations for QAOA

Quantum error correcting codes
Types of error,s Device Level, Metrics System Level, Metrics Benchmarking, Analyze software-based techniques for reducing the error rate of NISQ, Variability-Aware Mapping Diversity-Aware Mapping Reducing Measurement Errors Reducing Idling Errors

Quantum cryptography
Quantum key distribution, Bell's theorem and EPR paradox
Text & References:

- Nielsen, Michael A., and Isaac L. Chuang. *Quantum Computation and Quantum Information.* Cambridge, UK: Cambridge University Press, September 2000. ISBN: 9780521635035.
- Preskill, J. Notes on Quantum Computation.
- Peres, Asher. *Quantum Theory: Concepts and Methods.* New York, NY: Springer, 1993. ISBN: 9780792325499.

Elective–3
Automata&NaturalLanguageProcessing(MCSE402A)

Module-1:Deterministic finite automaton and non-deterministic finite automaton.Transition diagramsand LanguageRecognizers.
Finite Automata: NFA with Î transitions - Significance, acceptance of languages.ConversionsandEquivalence:EquivalencebetweenNFAwithandwithoutÎtransitions.NFAtoDFA conversion. MinimizationofFSM,Limitations ofFSM
Module-2:RegularLanguages:Regularsets.Regularexpressions,identityrules.
ConstructingfiniteAutomataforagivenregularexpressions,Regularstringacceptedby NFA/DFA
Pumpinglemmaofregularsets.Closurepropertiesofregularsets.
GrammarFormalism:Regulargrammars-
rightlinearandleftlineargrammars.Equivalencebetweenregularlinear grammarandFA.
Module-3:ContextFreeGrammarandConstituency,SomecommonCFGphenomenaforEnglish,Top-DownandBottom-upparsing,ProbabilisticContextFreeGrammar,DependencyParsingPush downAutomata:Pushdownautomata,definition.
TuringMachine:TuringMachine,definition,DesignofTM
Module4:RegularExpressionsandTokenizationIntroductiontoNLP

WordTokenization,Normalization,SentenceSegmentation,NamedEntityRecognition,MultiWordExtraction,SpellChecking–BayesianApproach,MinimumEditDistance
Morphology:Morphology–
InflectionalandDerivationalMorphology,FiniteStateMorphologicalParsing,TheLexiconand
Morphotactics,MorphologicalParsingwithFiniteStateTransducers,OrthographicRulesandFiniteStateTransducers,PorterStemmer
Module5:IntroductiontoN-grams,ChainRule,Smoothing–Add-OneSmoothing,Witten-BellDiscounting;Backoff,DeletedInterpolation,N-gramsforSpellingandWordPrediction,Evaluationoflanguagemodels.
Module6: Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – OpinionMiningandEmotion Analysis,ResourcesandTechniques
Module7:IntroductiontoLexicalSemantics–Homonymy,Polysemy,Synonymy,Thesaurus–WordNet,ComputationalLexical, Semantics–ThesaurusbasedandDistributionalWordSimilarity

TextBooks:

1. HopcroftH.E.andUllmanJ.D.,IntroductiontoAutomataTheoryLanguageandComputation,Pearson.
2. Mishra and Chandrashekaran, Theory of Computer Science, Automata Languages andcomputation,PHI
3. C.K.Nagpal,FormalLanguagesandAutomataTheory,Oxford
4. ManningandSchutze,Foundationof Statistical Natural Language Processing,MITPress

Cryptography and Blockchain(MCSE402B)

Introduction: Key Innovations/Revolutions in Human History, Evolution of Economic System, Money, Ledger and Accounting, Digital Revolution & its impact across industries, Digital Money, DigiCash, E-Gold

History & Fundamentals of Blockchain, Key Elements of Blockchain, Blockchain Protocols, Benefits of Blockchain, Types of Blockchain, Centralized vs. De-centralized systems

Cryptography, Symmetrical vs. Asymmetrical Encryption, Secure Hash Algorithms (SHA Family), Comparison of SHA functions, Digital Signatures

Consensus Mechanisms – Objectives & Need, Proof of Work (PoW), Proof of Stake (PoS), Types & Functions of Node, Construct of Block, Public vs. Private Keys

Types of Ledger, Ledgers, Distributed Ledger Technology (DLT), Benefits & Use Cases of DLT, Smart Contract

Text & References:

- Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World, 978-1101980149, 978-1260026672, Don and Alex Tapscott
- Cryptoassets: The Innovative Investor's Guide to Bitcoin and Beyon, by Chris Burniske and Jack Tatar
- The Basics of Bitcoins and Blockchains: An Introduction to Cryptocurrencies and the Technology that Powers Them (Cryptography, Derivatives Investments, Futures Trading, Digital Assets, NFT) Hardcover – Illustrated, September 15, 2018, Antony Lewis,
- The Blockchain Developer: A Practical Guide for Designing, Implementing, Publishing, Testing, and Securing Distributed Blockchain-based Projects 1st ed. Edition, Apress, 978-1484248461, 2019

SocialNetworkAnalysis(MCSE402C)

Introduction to Social Network Analysis: The Social Network Perspective,
HistoricalFoudations,FundamentalConceptsinNetworkAnalysis,DistinctiveFeaturesofSocialNetwork,Rel
atedstatisticaltoolsofSocialNetworks
MathematicalRepresentationofSocialNetworks:NotationforSocialNetworkData,GraphTheoreticNot
ation,Sociometric Notation,AlgebraicNotation,GraphsandMatrices
GraphicTechniquesforExploringSocialNetworkDataandCentrality:Degreecentrality,
Betweenness centrality, Closeness centrality, Igenvector
centrality,TransitivityandReciprocity
Software forSocialNetwork Analysis:Introductiontothe Toolsof
SocialNetworks,OverviewonGephiandNetlogo
ModelsandMethodsinSocialNetworkAnalysis:RandomGraphModel,SmallWorldModel,PreferentialAttac
hmentModelandpower-laws
DiffusiononNetworks:InformationDiffusionandCascadeModel,Epidemics–
SIR&SISModel,ThresholdModel,Simpleandcomplexcontagion
ApplicationofDataMininginSocialNetworks:OverviewonDataMininganditsvarioustechniques,Overviewo
nWebMining
Recommendationsystem:Concept,Content-basedmethod,Collaborativefiltering,Applications

TextBooks:

1. DavidEasleyand JonKleinberg,Networks,Crowds,andMarkets:Reasoning about a HighlyConnectedWorld,CambridgeUniversityPress,2010
2. Zafarani,AbbasiandLiu,SocialMediaMining:AnIntroduction,CambridgeUniversityPress,2014

Bioinformatics (MCS492D)

Bioinformatics and Biological Sequence Databases
Overview of Bioinformatics, computational biology, History, Human Genome Project, Biological Sequence Databases (Primary, Secondary, composite), NCBI, PDB, bibliographic databases

Sequence Alignment
Sequence analysis of biological data, methods of alignment and methods for optimal alignments, dynamic programming, using gap penalties and scoring matrices, multiple sequence alignment tools for MSA (MUSCLE, T-coffee), Similarity Searching Tools: BLAST and FASTA,

Molecular Phylogeny
The concept of evolutionary tree terminology of phylogenetics, introduction to evolutionary models, Types of phylogenetic trees (rooted vs. unrooted trees).Phylogenetic analysis algorithms: UPGM, Fitch Morgalish, Neighbors-Relation, Neighbor-Joining, maximum Parsimony, maximum likelihood, Tree evaluation methods: Bootstrapping, Randomized and jack-knifing methods

Predictive Methods
Gene Identification methods, Protein structure prediction methods: Secondary and tertiary approaches

Molecular modelling & Drug designing
Molecular docking and virtual high-throughput screening,

Systems Biology
The process of system biology research, Interlinkage of Genomic, Transcriptomics, Proteomics, Lipidomic, Interactome and metabolomics

Text & References:

1. Bioinformatics: Sequence and Genome Analysis, D.W. Mount, Cold Spring Harbor Laboratory Press.
2. Algorithms on Strings, Trees, and Sequences: Computer Science and Computational Biology, D. Gusfield, Cambridge University Press.
3. Biocomputing hypertext coursebook at http://www.techfak.unibielefeld.de/bcd/Curric/welcome.html/
4. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, A.D. Baxevanis and B.F.F. Ouellette, Wiley-interscience.
5. Computational Modeling of Genetic and Biochemical Networks, J.M. Bower and H. Bolouri, MIT Press
6. Computational Molecular Biology: An Algorithmic Approach, P.A. Pevzner, MIT Press
7. Computer Methods for Macromolecular Sequence Analysis, R.F. Doolittle, J.N. Abelson, M.I. Simon, Academic press
8. Essentials of Genomics and Bioinformatics, C.W. Sensen, John Wiley and Sons Inc.
9. Introduction to Bioinformatics, T. Attwood and D. Parry-Smith, Prentice Hall
10. Introduction to Computational Biology: Maps, Sequences and Genomes, M. Waterman, Chapman and Hall
11. Sequence Analysis in Molecular Biology: Treasure Trove or Trivial Pursuit, G. V. Heijne and G.V. Heijne, Academic Press

Distributed Computing (MCSE402E)

Evolution of Distributed Computing Systems, System models, issues in design of Distributed Systems, Distributed computing environment, web based distributed model, computer networks related to distributed systems and web-based protocols.

Inter process Communication, Desirable Features of Good Message-Passing Systems, Issues in IPC by Message, Synchronization, Buffering, Multidatagram Messages, Encoding and Decoding of Message Data, Process Addressing, Failure Handling, Group Communication. The RPC Model, Mechanism, Client-Server Binding, Exception Handling, Security. Some Special Types of RPCs, Optimizations and Performance.

Design and Implementation issues of DSM, Granularity, Structure of Shared memory Space, Consistency Models, replacement Strategy, Thrashing, Other Approaches to DSM, Advantages of DSM.

Desirable Features of a good global scheduling algorithm, Task assignment approach, Load Balancing approach, Load Sharing Approach, Process Migration, Threads, Processor allocation, Real time distributed Systems.

Desirable Features of a good Distributed File Systems, File Models, File Accessing Models, File-sharing Semantics, File Caching Schemes, File Replication, Fault Tolerance and Design Principles. Case studies: comparison of NFS and AFS. Implementing Java RMI, RPC. TCP, FTP, UDP programming

Text & References:

- Distributed OS by Pradeep K. Sinha (PHI)
- Tanenbaum S.: Distributed Operating Systems, Pearson Education
- Tanenbaum S. Maarten V.S.: Distributed Systems Principles and Paradigms, (Pearson Education)
- George Coulouris, Jean Dollimore. Tim Kindberg: Distributed Systems concepts and design.

(Practical Lab-4)

Artificial and deep Neural network Lab (MCS493)

Neural Network Representation, Computing a Neural Network's Output, Vectorizing across multiple examples, Calculation of Activation functions, non-linear activation functions, Derivatives of activation functions, Gradient descent for Neural Networks, Backpropagation intuition, Random Initialization using case studies

Calculation of Logistic Regression Cost Function, Implementation of Gradient Descent, Derivatives, More Derivative Examples, Computation graph, Derivatives with a Computation Graph, Logistic Regression Gradient Descent, Gradient Descent using case studies

Developing a Deep L-layer neural network, Understanding Building blocks of deep neural networks, Forward and Backward Propagation

Text & References:

- • Deep learning: adaptive computation and machine learning by Bengio, Yoshua, Courville, Aaron, Goodfellow, Ian J
- • Deep Learning: A Practitioner's Approach by J. Patterson, A. Gibson
- • Neural Networks and Deep Learning: A Textbook by Charu C. Aggarwal
- • Neural Networks and Deep Learning by Michael Nielsen

3/10/202